Gas Journal

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Editorial Notes

Lighting Apathy

Long before Mr. F. C. Smith delivered his Address as President of the London and Southern District Junior Gas Association we had considered him as typifying a new spirit animating the Gas Industry's research workers. His paper at the annual meeting of the Association of Public Lighting Engineers held in Blackpool last year did a great deal for the Gas Industry. Apart from proclaiming him as an " onion magnate "—we refer to lux and lumens, and not to tears—that paper was a proclamation on behalf of the Gas Industry. It indicated that the Industry must not sit back on illumination problems. There was, to our mind, a lesson to be learned from the paper, which was subsequently presented at the 1933 Autumn Research Meeting of the Institution of Gas Engineers. That lesson has not yet been learned.

The science of lighting is a difficult game. We pre-suppose that our Industry *wants* the lighting load—in spite of evidence to the contrary expressed by apathy in some quarters. Yet we are left with the definite impression that this want is a cry in the air rather than a root in the ground. Our justification for this idea is simply that the Gas Industry will not suffer lighting experts. An onion diagram is regarded as a curiosity, and the gas man who knows anything about it as an eccentric. This, without a doubt, shows how sickly are the Gas Industry's desires to retain the lighting business and to cope with competition. Apart from a few notable examples, to whom every credit is due, we are, comparatively, standing still in lighting research, and the electricians are smugly laughing at us.

Take the Illuminating Engineering Society. This august body started the session ball rolling by a report on the progress of lighting during the past year. Gas lighting progress occupied a place in the report, but it was by no means a " fauteuil." Even so, it had a better showing than recorded in some previous reports; but merely an isolated endeavour. Take the Association of Public Lighting Engineers as expressed by the annual meeting in Aberdeen last month. With one exception, the scientific interest was contributed by electricians. The Gas Industry sends its delegates to the meetings of both Societies. It is obvious that, in general, it does so as a matter of form, demanding of them representation, and *not* originality. This is a weakness which must be remedied.

Illumination, whether it be by gas or electricity, tallow candles, or the moon, remains illumination; and we suggest that a little more appreciation of this fact would do our Industry a power of good. Street lighting, for instance, is not solely a question of B.S.I. mounting height or the cheapness of a light source. Efficient street lighting involves a mass of variables, not the least important of which is the nature of the road surface—in which the Gas Industry is vitally interested. How many undertakings in the Gas Industry are willing to pay men to assess these variables? The electricity industry is prepared to do it—simply because of the belief that illumination matters. We may gull ourselves that a certain new form of electric lighting is a powerful blow to maidens' " make-up; " but our arguments, like the " make-up," won't wash.

As we see it, the Gas Industry is sitting on its mantles—and mantles are fragile. B.Th.U. per candle-power is merely one note in the chord of illumination. On the other hand, our competitors are surveying the problem *as a whole*. In vulgar parlance, we are inclined to think that the Gas Industry as a whole is satisfied to sit " up the 13 ft. B.S.I. pole." Which is one of the lessons to be learned from Mr. F. C. Smith's discourse to the London Juniors.

A Pointer to the Industry

We regard Mr. Smith's Address as a pointer to what the Industry might do. The Address itself is lengthy; we can only publish part of it this week. It is a sign-post not only to illumination problems, but to others. Why can't we, for example, insist on a limited range of variation in the specific gravity of the gas supplied to that very humble servant, the salesman? It needed an Act of Parliament, fourteen years ago, to enable the salesman to deal with heat instead of cubic feet. This Act is complied with—it has to be! In spite of every research of the Institution of Gas Engineers, the American Gas Association, and the United States Bureau of Standards—to say nothing of equally valuable investigations in France and Germany—the designer of a gas burner knows that his nice calculations may in practice prove meaningless. We ought to work to an agreed composition code, with adequate specific gravity clauses.

In this connection Mr. Smith rightly puts in a plea for a greater measure of co-operation between producer and seller of gas. The designer, he argues, should make the burner to operate over as wide a range of gravities and compositions as is consistent with the highest service to the customer, and should acquaint the gas engineer of these limits. Then, in his turn, the gas engineer should maintain the specific gravity and composition as constant as economically possible, and in no circumstances should he permit variation outside the limits imposed by the most sensitive apparatus on the district.

As a general rule lighting burners are a good index to permissible variation; some undertakings, in fact, adopt these burners as the criterion.

On the design of burners, as on the questions of combustion, space heating, and lighting, Mr. Smith sets out a great deal of fundamental information gained as a result of research in this and other countries; and we are in complete agreement with him that it is necessary to broaden our outlook on the trend of scientific thought in general. We must be aware of developments in other fields and modify our ideas, if need be, to comply with new but well-established principles. In the matter of heating, for instance, conditions of comfort and environment play an important rôle in the success of any gas installation, and the conditions which make for comfort should be well known to sellers of gas. There can be no question that our Industry cannot do itself justice unless it is in the van of relevant research. In regard to comfort conditions and environment Mr. Smith has a tilt against the Home Office for retaining, in its Regulations controlling conditions in factories, the clause which demands that the carbon dioxide concentration in the air shall not exceed 12 parts per 10,000 when artificial lighting is not in use, and 20 parts per 10,000 during the period of artificial lighting. This clause is certainly unfortunate in that it gives rise to two major misunderstandings. First, it leads people to conclude that carbon dioxide is a poisonous gas; secondly, that, if the conditions laid down in the Regulations are complied with, then all is well. As a matter of fact, the Regulations may be complied with to the letter, and yet conditions may be far from happy. Mr. Smith emphasizes that "comfort" can only be secured by promoting conditions which regulate the rate of heat loss, and the method by which heat is lost, from the human body within well-defined limits, and that air temperature is only one factor affecting these considerations. And it is Mr. Smith's opinion that the Gas Industry would do well to develop low-temperature panel heating.

The Sulphur Bugbear

On another question of co-operation Mr. Smith echoes our own thoughts. Reduction or complete elimination of the sulphur in the gas is an end to be striven for even at considerable cost. Sulphur is not the only corrosive agent in the products of combustion of town gas, but we regard it as the most important. As we said in the "Journal" twelve months ago, "the utilization side of the Industry should arrive at some estimate of the corrosion costs caused by sulphur in gas—we appreciate the difficulty of this, how hard it is to single out one agent of corrosion and say, this costs me so much. It is not, however, beyond the wit of the Industry to come to some approximate figure." And it must be remembered that, apart from the cost of maintenance of appliances due to corrosion, there is the question of customer goodwill. The "tang" of sulphur dioxide, observable at such low and harmless concentrations as 0·0001%, is bad for the domestic lighting load and for the employment of perfectly safe appliances unconnected with a flue. In sulphur removal there is indeed need for co-operation between sellers and makers of gas. In fairness it must be mentioned that the manufacturing side is alive to the situation, and has undertaken a great deal of research. For example, the largest gas-works in the land is sending out gas containing only 7-8 grains of sulphur compounds per 100 c.ft., compared with an average quantity of about 25-30 grains per 100 c.ft.—an indication of what can be done to ensure a still more perfect gas service.

Oil from Coal

Over fifteen gallons of high-grade anti-knock petrol and over fifteen hundredweight of smokeless fuel per ton of "colliery waste." This is the claim of the National Coke and Oil Company, Ltd., who are operating a commercial-scale plant at Cannock. The Cannock process is sure to interest our readers, and we are able in our issue to-day to give an account of it. We are informed that "it has been established beyond all doubt that the yield of motor spirit alone is sufficient to cover all costs and pay a dividend. In addition, there is the smokeless fuel which can be sold as a bye-product. Locally, both the spirit and the smokeless fuel have been on sale for some time; and there could be no bigger tribute to the quality of the products than that the whole of the output of the existing two-retort plant has been sold for a year ahead."

Last week we had the privilege of inspecting the Cannock plant and learning at first-hand of the history of the process. Developments have been taking place quietly and steadily at Cannock for the past four years, and certainly the plant there, which has been in operation for a considerable time, is no "laboratory unit," each retort being capable of dealing with 37 tons of coal per day. Mr. W. B. Mitford is at the head of the enterprise, and in addition to Mr. Mitford the Board of the Company consists of Sir Thomas D. Edelston, Major E. G. Munro, Mr. Arnold S. Rowntree, and Mr. Corbet W. Woodall. Their aim is to install standard unit plants, each of a capacity of 75 tons of coal per day, or multiples of such units, throughout the country, and we are told that plans are already advanced for the erection of plants on the Cannock process at Edinburgh, Cardiff, Manchester, Birmingham, and on the Thames—surely an indication of their faith in the new system.

A word or two about the Cannock "wet charge" process. The coal—or, rather, a blend of coking and non-coking coals—is pulverized and then intimately mixed with coal distillate (creosote) previously produced by the plant, together with a make-up of industrial creosote amounting to about 18 gallons per ton (a matter of 8% of the total oil). The final mixture is approximately 50% coal and 50% creosote. This is charged into a rotating, slightly inclined, steel retort, the period of carbonization or distillation being $2\frac{3}{4}$ hours only. The vapours evolved are exhausted at the top end of the retort, and are then subjected to condensation. The permanent gas, which is employed to provide the bulk of the heat required for heating the retort, passes to a holder, whence it is boosted to the combustion chamber burners. The "petrol" is distilled from the condensate, and is washed and "topped." The smokeless fuel is discharged continuously at the lower end of the retort, is lightly quenched in an airtight container, and then belt-conveyed to a screening and grading plant. This is the bare outline of the plant, from which it will be gathered that the essential feature which characterizes the process is that the coal is charged in a creosote vehicle.

Dr. Lander's Support

For the past year Dr. C. H. Lander, formerly Director of Fuel Research, Department of Scientific and Industrial Research, and now Professor of Engineering at the Imperial College of Science and Technology, has been actively engaged in investigating the process. His experience of low-temperature plants in general, processes to extract petrol from coal, extends over fourteen or fifteen years, and is, we suggest, unique. He frankly admits that when he was approached a year ago to investigate the Cannock process he did so in a spirit of

agnosticism regarding the claims advanced. After twelve months' contact with the process, however, he has become a firm believer in both its actualities and its possibilities. Included in our account of the Cannock plant are extracts from Dr. Lander's report on a test of a week's duration on one retort by a specially engaged technical staff working under his supervision. We repeat here a few sentences from the report:

"Raw materials in the proportion of 1 ton of coal fines together with 18·9 gallons of industrial creosote were mixed with sufficient coal distillate previously produced by the plant to bring the resultant mixture to approximately 50% solid coal to 50% liquid.

"There were produced 15·3 gallons of motor spirit ready for sale to local garages, 15·6 cwt. of smokeless fuel, and 4·5 gallons of heavy oil.

"The heavy oil is ready for immediate re-use with further coal fines without any treatment.

"It is my considered opinion, based upon a critical study of the process, that this quantity of 15·3 gallons of high anti-knock value petrol could be increased and an even higher grade of spirit produced by a more efficient condensing system and certain simple modifications in the topping plant."

Also there is "no apparent deterioration in the qualities of the oil, which, after having the petrol removed, is returned to the plant for mixing with further coal fines, thus obviating the necessity for using fresh creosote, other than the make-up of 18 gallons."

In face of such a report by so eminent an authority it is with diffidence that we offer any criticism. There are, however, one or two points which require consideration. The first is whether it will be generally accepted that a test of one week on a plant processing coal in such a huge quantity of vehicle is of sufficiently long duration to arrive at firm and definite conclusions. Then we should like detailed analyses of the creosote serving as a vehicle. Also, the ash content of the coals charged has an important bearing on the value of the smokeless fuel for burning in the domestic hearth. Again, is it safe to assume that a process of this nature, which may prove a paying proposition when adjacent to a colliery and enjoying favourable local conditions in regard to the marketing of the products, will necessarily be equally profitable when the raw material has to be transported over considerable distances? Many schemes have foundered on this one rock.

We are, however, impressed with the fact that, before the National Coke and Oil Company decided to forge ahead with what is a most ambitious programme, they had valuable experience with a commercial unit; and we wish the enterprise all success. It does seem strange, though, that the public imagination is so readily fired by low-temperature carbonization and oil-from-coal schemes, and so neglectful of the work of the Gas Industry in making a healthier Britain, the while producing millions of gallons of motor spirit.

Where do we Stand with Legislation?

It is reasonable to suppose, whatever the feelings of the Gas Industry in the matter, that legislation relating to its control is likely to remain stabilized for some time to come, now that the Gas Undertakings Act of 1934 is passed. This Act, following on those of 1920, 1929, and 1932, has produced, or will produce, important changes in the powers of gas undertakings, both statutory and non-statutory. The whole Industry, since Royal Assent was given to this year's Act, has had to take stock of its position—each undertaking having to consider not only in what way its status is affected, but also to what extent additional legislative freedom will enable it the better to carry on its business.

In view of this situation, we believe the Industry will welcome as particularly opportune a short series of articles which Mr. George Evetts, beginning with the present issue, is contributing to the "Journal." In these he summarizes and explains the present-day legislative status of gas undertakings, outlining the importance of the powers possessed by the Industry, while at the same time indicating where he thinks that deficiencies exist.

It will be found that, while Mr. Evetts considers that there are, of course, onerous restrictions still in force, and that at least one important power has been withheld, the average gas undertaking, taking it all round, cannot complain that it is prevented from developing and carrying on its work in a businesslike and efficient manner. We believe that the summary of the position contained in this series of articles will prove not only of immediate assistance, but will serve as a most useful reference work to gas undertakings of all sizes for some time to come. Particularly should they be helpful to the smaller undertakings, of whose welfare the "Journal" has ever been mindful, and whose continuous development towards ever-increasing efficiency is of such vital importance to the whole Industry at the present juncture.

Co-partnership and National Thrift

So much time has been taken up during recent years in considering rising expenditure for public and private purposes, that the other side of the question has perhaps been allowed to drift a little into the shade. Who has not heard the argument: "What is the use of trying to save? If one succeeds, somebody is sure to come along and take the savings." Plausible, perhaps. But actually the argument is not sound; for the greater demands upon our purse, the more urgent becomes the need for thrift. And in spite of the unpromising conditions, thrift not merely still exists, but grows apace.

This is a fact which is well worth noting in an industry such as our own, wherein much attention has been paid to creating small capitalists from among its employees. As a leader in the adoption of co-partnership, the Gas Industry has done invaluable work in the great cause of thrift; and as an out-and-out supporter of the principle the "Journal" may claim to have had a no small share in this work. Amid all the problems that the War and succeeding years brought in their train, co-partnership has been somewhat overshadowed, journalistically speaking, but looking back beyond this period we find a large proportion of our space devoted to the subject. Not for a moment is this regretted; on the contrary, we still take pride in reflecting upon our share in helping along the road to success a movement which had for its object the raising of the status of an employee to something higher.

Quite a number of gas companies joined the ranks of co-partnership undertakings, and from the reports of the periodical meetings one gathers the magnitude that the schemes of the great London Gas Companies have attained. But is there not reason for sowing seeds of this beneficent tree in new soil—the soil of those many concerns which still remain without the advantages of its luxuriant foliage? Foliage which offers comfort to the employee and a reliable safety factor to the employer. Life now is speedier and more complicated, less certain in some respects, more hazardous in others. Hence

a greater need for thrift. To only some of us is given the privilege of remembering the eloquent advocacy of that great pioneer, George Livesey; but to all is offered the benefit of his example. To encourage thrift is a duty, and no better method of doing so than by means of a system of co-partnership lies to the hand of administrators of gas undertakings.

In spite of the evidence of pleasure-seeking that to-day confronts one at every turn, there is available the surest proof that efforts to save still continue to be made, and with success, by wage earners, and this should be an incentive to the establishment of further schemes of a co-partnership, or profit-sharing, character. It has just been announced by Lord Mottistone, the Chairman of the National Savings Committee, that, so far from there having been a decline in the habits of thrift and saving power of the small investor, there has actually been a very remarkable advance. According to the latest estimates, the total standing to the credit of small investors in the State-controlled schemes and in other thrift organizations, such as building societies, friendly societies, and trades unions, is £2,543,000,000, or over £56 per head of the population. "These figures," his Lordship added, "are astronomical figures, and no other country in the world can show anything like them. In this country alone among the great countries saving has gone up." The facts quoted are reassuring in an even wider sense than we have been considering here. Greater savings mean extended realization of personal responsibility, and this, in its turn, must have a beneficial effect upon the affairs of the nation. The interest paid by savings goes far beyond the mere monetary return.

Gas Supply

THERE has for some time been a noteworthy deficiency in publications dealing with gas distribution, and the Industry has been intrigued of late by rumours of a new work on the important subject of supply. If size is any criterion, the deficiency of many years is made up by the recent appearance of the "Science and Practice of Gas Supply," in three volumes, by Arthur Coe.

It is no part of our business in these columns to boost, from the commercial viewpoint, anybody's book on any subject, but, since we know that there is a very general demand for a work on that very important branch "supply," we feel sure our readers will turn with special interest to the first published review of Mr. Coe's book, which appears on a later page of this issue.

As we fully appreciate that size *is* no criterion of the value of a book, we are particularly pleased to be able to give to the Gas Industry the judgment of so eminent a reviewer as Dr. E. W. Smith. If the work meets with the general approval which Dr. Smith's estimate of it would seem to indicate, the Industry will make full use of it for its own educational purposes. Beyond this, we would suggest that, for its size and importance, our Industry is but poorly represented in the public libraries—both technical and general. If—and again we must leave the question to the decision of others—Mr. Coe's work proves acceptable, perhaps gas undertakings will consider remedying the above state of affairs by, as a beginning, presenting their local libraries with a copy. It deals with a subject of rather more general interest than some others which are more highly technical; and once the good habit was formed, the seeker among the general public after knowledge could, at comparatively small cost to the Gas Industry, be as fully satisfied on gas matters as he is by many other industries. Which would be all to the good of the Gas Industry.

Personal

Mr. H. LESLIE BOYCE, M.P., who recently resigned from the Board of the Gloucester Gas Light Company, has become a Director of the Severn Valley Gas Corporation, Ltd. Mr. Boyce is Chairman of the Gloucester Railway Carriage and Wagon Company, Ltd., and a Director of a number of other well-known companies.

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After more than six years' service as Engineer and Manager of the Port Chalmers (New Zealand) Gas Department, Mr. DUNCAN MACPHERSON has been appointed to a similar position with the Marton Borough Gas Undertaking and took up his new duties early this month.

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Mr. GILBERT B. HOWARTH, M.C., M.Sc., A.I.C., who was Chief Chemist with the Newcastle and Gateshead Gas Company, was appointed Fuel Technologist to the Government of New South Wales last September and sails on Nov. 2 to take up his duties abroad. On leaving the Company he was the recipient of a valuable set of technical books. His many friends in the Gas Industry will join us in our good wishes for a successful future.

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Mr. S. JONES, Assoc.M.Inst.Gas E., of the Blackpool Corporation Gas Department, has been successful in the recent examination for admission to Associate Membership of the Institution of Chemical Engineers. Mr. Jones was formerly on the staff of the Swansea Gas Light Company.

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Mr. G. ANTHONY COWEN, of Shotley Bridge, who recently resigned an appointment with the Consett Iron Company and joined the staff of Messrs. Parkinson & Cowan (Gas Meters), Ltd., to represent their interests in the North of England, has been appointed a Director of the Parkinson Stove Company, Ltd., Birmingham.

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The appointment of M. PHILIPPE VERNES as President of the Compagnie Continentale du Gaz in succession to the late M. Felix Vernes is announced.

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Mr. JOHN REES, Secretary of the Dowlais Gas and Coke Company, is retiring after 31 years' service. His successor is Mr. I. F. GRIX, A.C.I.S., who was formerly Assistant Secretary and Accountant to the Nuneaton Gas Company.

Forthcoming Engagements

October

25.—COKE OVEN MANAGERS' ASSOCIATION.—Annual General Meeting and Dinner at the Hotel Victoria, London.
25.—EASTERN COUNTIES ASSOCIATION.—Autumn Meeting at 28, Grosvenor Gardens, S.W. 1.
26.—B.C.G.A.—Scottish District Conference, Dundee.
26.—MANCHESTER DISTRICT ASSOCIATION.—General Meeting at Midland Hotel, Manchester.
27.—WALES AND MONMOUTHSHIRE JUNIOR ASSOCIATION.—Opening Meeting and Presidential Address of Mr. J. W. Howells, of Neath.
29.—LONDON AND COUNTIES COKE ASSOCIATION.—Executive Committee, 11 a.m.; Central Committee, 12 noon; Luncheon, 1 p.m.; Third Annual General Meeting, 2.30 p.m., at Hotel Metropole, Northumberland Avenue, London.

November

1.—MIDLAND ASSOCIATION.—Autumn General Meeting, Grand Hotel, Birmingham, 2.30 p.m. Paper by Dr. F. S. Sinnatt.
1.—MIDLAND JUNIOR ASSOCIATION.—Meeting in Birmingham. Paper by Mr. J. A. Johnston.
3.—WESTERN JUNIOR ASSOCIATION.—Meeting at Bristol. Paper by Mr. A. T. Gilbert.
6 and 7.—I.G.E.—Autumn Research Meeting.
8.—S.B.G.I.—Council Meeting, 11.30 a.m.
8.—S.B.G.I.—Autumn General Meeting, Hotel Metropole, 2.30 p.m.
21.—B.C.G.A.—Manchester District Conference at Altrincham.
21.—B.C.G.A.—Meeting of Executive Committee, 28, Grosvenor Gardens, S.W. 1, 12 noon.
24.—N. OF E. AUXILIARY ASSOCIATION.—Half-Yearly Meeting at Newcastle. Paper by Mr. W. O. Kirkwood.
30.—SOUTHERN ASSOCIATION.—General Meeting, Hotel Metropole, London, 2.30 p.m.

News In Brief

New Coke Screening and Grading Plant is to be installed at the gas-works of the Dumbarton Town Council at a cost of £1,202.

Cookery Lectures were recently given under the auspices of the Blackburn Corporation Gas Department at their showrooms by Miss Dorothy M. Gillham, of Messrs. R. & A. Main, Ltd.

Two Electricity Failures occurred at Perth on Oct. 17. The first occurred in the forenoon and the second in the late afternoon. No official explanation has been issued from the Electricity Station.

An Electricity Failure, lasting for nearly an hour, occurred at Orpington (Kent) on the night of Oct. 17. The postal and telephone services were completely upset until candles were secured or an auxiliary gas supply was turned on. Public meetings were delayed, and cinemas could not show their programmes.

The Midland Association are holding their Autumn General Meeting at the Grand Hotel, Birmingham, on Thursday, Nov. 1, at 2.30 p.m. After the formal business, a paper on the Hydrogenation of Low-Temperature Tar and Tar Products will be presented by Dr. F. S. Sinnatt, M.B.E., Director of Fuel Research.

Gas Progress at Budapest.—The report of the Gas Undertaking of Budapest (Hungary) for 1933 shows that the sales of gas during the twelve months attained a total of 3,170,405,000 c.ft. as against 3,344,773,000 c.ft. in 1932, a decrease of about 5·2%. There was an increase in the number of consumers from 108,899 to 109,512.

Application is Being Made by the Andover Lighting and Power Company for a Special Order under the Gas Undertakings Acts, 1920 to 1934, to extend the limits of supply to a number of parishes in the rural district of Andover and to authorize the Company to charge differential prices within the added limits—and for other purposes.

The Decision of the Glasgow Corporation to supply gas to residents in the villages of Hurlet and Nitshill, recently brought within the boundaries of the city, has been of great benefit to the local consumers. They formerly paid 9s. 2d. per 1,000 c.ft. for gas to the local Company, but under the Municipal scheme they will receive gas at 3s. 2d. per 1,000 c.ft.

For the Third Time in Two Years a reduction in the price of gas is announced in the city of Limerick, the present one being by 10%. A large sum of money has recently been expended on the installation of a new holder, retorts, and the laying of new mains and services. When work on these contracts has been completed it is anticipated that a still further reduction in price will be possible.

The Annual Meeting of the Gas Supply Company, Ltd. (Melbourne), was held on Oct. 1. The accounts for the year ended June 30, 1934, show a net profit of £14,607. The Directors declared a dividend of 6% per annum for the half-year ended June 30. As a result of further reductions in price the volume of gas sold was 18% greater than last year. The sales of appliances totalled 2,079 against 1,736 during the previous year.

Part of the Centenary Celebrations of Messrs. Ewart & Son, Ltd., took the form of a staff dinner and dance on Oct. 13 at the Connaught Rooms. There was a gathering of about 250, representing the staff of the London and Letchworth factories, with Mr. Samuel Ewart in the chair, supported by the other members of the Board. The toast "To the next hundred years" was proposed by Mr. Bunting and accepted with enthusiasm.

Imperial Continental Gas Association.—The Board of the Imperial Continental Gas Association have resolved that, out of the profits for the half-year ended Sept. 30, 1934, an interim dividend at the rate of 5% (actual) on the £5,600,000 Capital Stock of the Association be paid, less income-tax at 4s. 6d. in the £, on Nov. 15 next. The Transfer Books of the Association will be closed from Oct. 30 to Nov. 12, 1934, both days inclusive.

An Interesting Lecture on "Modern Gas Fires" was recently given by Dr. Winter to members of the Distribution Staff of the Haywards Heath Gas Company. An invitation to attend the lecture was extended to the Hassocks Gas Company and was gratefully accepted. Mr. A. E. Whitcher, Engineer, Manager, and Secretary of the Haywards Heath Gas Company, presided, and was supported by Mr. R. H. Gollings, Radiation Ltd., and Mr. J. Robinshaw, Engineer, Manager, and Secretary of the Hassocks Gas Company. A lively discussion followed Dr. Winter's lecture.

Recent Improvements at the West Bromwich Gas-Works, including the new horizontal water-tube condenser of three million cubic feet per day capacity, the new garage complete with car-washing machine and greasing apparatus, where all the Department's vehicles are now housed, and the workshop scheme now under construction were recently inspected by members of the Gas Committee.

Stirling Exhibition.—Stirling Gas Light Company held an exhibition of gas appliances in the Albert Hall, Stirling, from Oct. 15 to 20. The front of the building was floodlit during the week. The exhibition was opened by Mr. R. Keith Common, Chairman of the Company. Among the exhibitors, in addition to the Company, were the Parkinson Stove Company, Ltd., John Wright & Co., Ltd., R. & A. Main, Ltd., the Horstmann Gear Company, Ltd., Vitreosil Products, and the Economic Washing Machine Company.

The M.A.N. Company, of Nuremberg, Germany, announce that since the beginning of 1933 they and their licencees have built or have received orders for no fewer than sixteen gasholders of the waterless type, with an aggregate capacity of no less than 32,896,000 c.ft. The largest holder is one of 6,177,500 c.ft. for the gas-works at Dortmund and the smallest one of 105,900 c.ft. at Recklinghausen, Germany. Of the sixteen holders, it is noteworthy that the largest number—six—are in Great Britain and Ireland as against three in Germany, and one each in seven Continental countries.

A Floodlit Carnival Exhibit was entered by the Dudley, Brierley Hill, and District Gas Company in the night-time procession which was recently held in aid of the Brierley Hill Hospital. In addition to being floodlit, the entry carried a built-in fire which was burning and a cooker on which a kettle was boiling on each side of the vehicle. Accompanying the entry were children dressed as Mr. Therm. Three youths similarly attired carried gas meter case collecting boxes. The designing and construction of the entry was carried out by the Company's own staff and men, with the exception of the Mr. Therm costumes, which were made by the British Commercial Gas Association.

Shock from Electric Kettle.—An Ilford woman was awarded £300 damages against Ilford Corporation in the King's Bench Division on Oct. 17 for injuries received while using an electric kettle. Her husband, an accountant, was awarded £102. Ilford Corporation installed an electric cooker, an iron, and kettle, and the case was that there was a defect in the wiring. The Corporation admitted liability, and the only question was the amount of damages. Mr. Justice Swift said the accident was of a horrible character. The woman received an electric shock as if she had been struck by lightning or was undergoing the penalty of electrocution. Judgment was entered for £402 and costs.

A Compliment was paid to the Yeadon and Guiseley Gas Company by Mr. Sydney Howard, the stage and screen comedian, for painting their holders to harmonize with the countryside. In an article which he contributed to the *Yorkshire Evening Post* on Oct. 18 on the danger of spoiling the English countryside by commercial development, he says of Yorkshire's scenic beauty: "Are we going to sacrifice our birthright for commercial efficiency, or are we going to realize our continual boasts of home affection—to cry 'Hands off Yorkshire' to her would-be despoilers? I sincerely believe the latter will be the case, and I am encouraged in this view by something I read some time ago in connection with my birthplace, Yeadon. This was nothing more than a decision to paint the local Gas-Works so as to make it harmonize with the beauty of its surroundings."

The Varied Uses to which gas is being put in Dublin and elsewhere in the Irish Free State was commented upon in an address by Mr. Francis J. Dickens, Chairman of the Alliance and Dublin Gas Consumers' Company. In the city itself it has recently been installed for the ripening of bananas, the heating and steam raising for Turkish baths, and for conditioning lager beer in public houses. During the past six months the quantity of coal carbonized by the Company reached the record figure of 82,000 tons, necessitating the purchase of an additional collier. A benzole recovery plant is at present being installed. The loss in respect of unaccounted-for gas has been substantially reduced and now compares favourably with other undertakings. Special efforts are being made to encourage the use of coke and are proving more successful than was at first anticipated.

Provisional Programme of the Autumn Research Meeting of the Institution.

Monday, Nov. 5.

7. 0 p.m. Inaugural Dinner of the British Gas Federation, Grosvenor House, Park Lane, W. 1.

Tuesday, Nov. 6.

10. 0 a.m. to
11. 0 a.m. (1) Secretary to read the Notice convening the Special General Meeting.
(2) 11th Report of the Gas Education Committee, 1933-34. (Communication No. 98.)
*(3) Education Regulations – 1934 Revision. (Communication No. 105.)
(4) Presentation of Diplomas.
11. 0 a.m. to
12. 0 noon. (5) 5th Report of the General Research Committee, 1933-34. (Communication No. 99.)
*(6) Report on the Use of Coal Tar Oils in Internal Combustion Engines, by H. M. Spiers, M.A., B.Sc., F.I.C., and E. W. Smith, C.B.E., D.Sc., M.Inst.Gas E., F.I.C. (Communication No. 95.)
12. 0 noon to
12.30 p.m. (7) Institution Gas Research Fellowship Report, 1931-34. (Communication No. 104.)

3. 0 p.m. to
4.30 p.m. (8) 4th Report of the Liquor Effluents and Ammonia Sub-Committee. (Communication No. 102.)

Wednesday, Nov. 7.

10. 0 a.m. to
11.15 a.m. (9) 34th Report of the Joint Research Committee. (Communication No. 100.)
11.15 a.m. to
12.30 p.m. (10) 25th Report of the Refractory Materials Joint Sub-Committee. (Communication No. 103.)
*(11) Standard Specifications for Refractory Materials for Gas-Works. (Communication No. 94.)

2.30 p.m. to
3.45 p.m. (12) 35th Report of the Joint Research Committee. (Communication No. 101.)
*(13) Notes on the Visit of the Institution of Gas Engineers to Canada and the United States of America, 1933, by F. J. Dent, Ph.D., B.Sc. (Communication No. 96.)
3.45 p.m. to
4.15 p.m. (14) General Discussion on Gas Research and Investigations.
4.15 p.m. to
4.30 p.m. (15) Concluding Business.

* For Presentation only: any Discussion to arise on the preceding Report. Otherwise, all Reports are for Discussion.

Centenary Celebrations at Bury St. Edmunds.

A review of the progress of the Gas Company in Bury St. Edmunds during the last 100 years was given at the centenary celebrations of the Company on Oct. 16, when a large company was entertained to luncheon in the town's historic Guildhall by the Directors.

The Chairman of the Directors (Ald. J. Ridley Hooper) presided at the luncheon, and the Mayor (Ald. E. L. D. Lake), Chairman of the Borough Electricity Supply Committee, replying to the toast of "Our Guests," said he was convinced there was as great a future for gas as there was for electricity.

Responding to the toast of "The Gas Industry," proposed by Captain F. F. A. Heilgers, M.P., Sir Francis Goodenough, Chairman of the British Commercial Gas Association, said that the number of gas appliances sold in the last twelve months was a record.

Scottish Junior Gas Association (Western District).

The opening meeting of the Scottish Junior Gas Association (Western District) was held in the Royal Technical College, Glasgow, on Saturday, Oct. 13—Mr. Samuel McGown (Glasgow) presiding in the absence of Mr. Alex. Tran (Bath), the Past-President.

Mr. McGown, introducing Mr. Greig, the new President, wished him every success during his term of office and appealed to the members to give him their loyal support.

Mr. Greig proceeded to read his Presidential Address dealing with the plant at Dawsholm, and in conclusion was warmly thanked.

Exhibition of Gas Lighting at Liverpool.

Meeting of Illuminating Engineering Society.

A number of gas lighting exhibits were displayed at the meeting of the Illuminating Engineering Society held in the Walker Engineering Laboratories at the University of Liverpool on Oct. 16.

List of Gas Exhibits.

The following comprised the exhibits:

W. Parkinson & Co.
10-light upward beam alignment floodlight lamp, with suit-base for floor or table.
6-light "Rotherham" suspension lamp, complete with parabolic interior "Mor-lites" and directional wing.
10-light "1700" series suspension lamp, complete with 3-tier 12-faceted wing.
4-light No. 480 18-in. square lamp, complete with curved top and "Mor-lite" reflectors, mounted on short cornolith column.
"Mor-lite" range, including 2-way parabolic and 2-tier 8-faceted directional.
Sinusoidal diagram model, diagrams, &c.

William Sugg & Co.
"Arcade" lamp.
"Worklux" fitting.

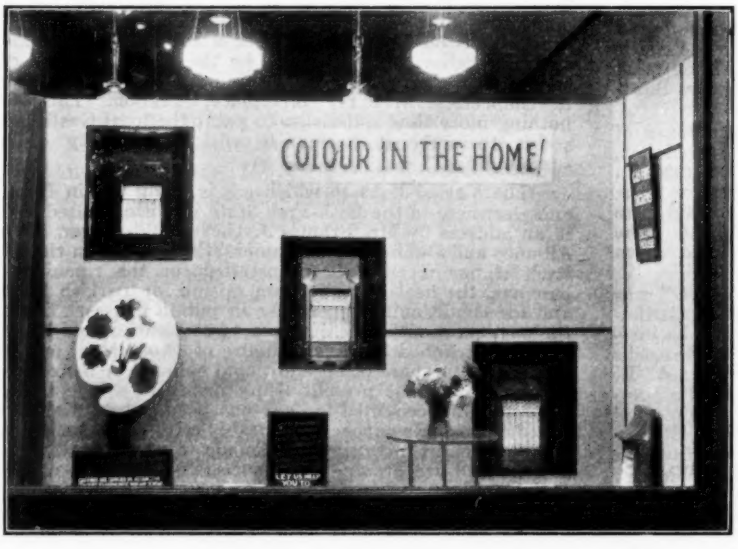
Horstmann Gear Company, Ltd.
This exhibit consisted of the firm's latest development in automatic street lighting control and gas switches for domestic lighting.

William Edgar & Son, Ltd.
1 chromium-plated Edgar's "Rivercourt" lamp, with 5 nozzles and obscured well glass.
1 chromium-plated new pattern wall bracket, complete with burner and obscured cylinder.
1 "Holgas" lamp.

Jas. Keith & Blackman Company, Ltd.
No. 808 new pattern 3-burner cluster high-pressure lamp.
New pattern low-pressure indoor fitting.

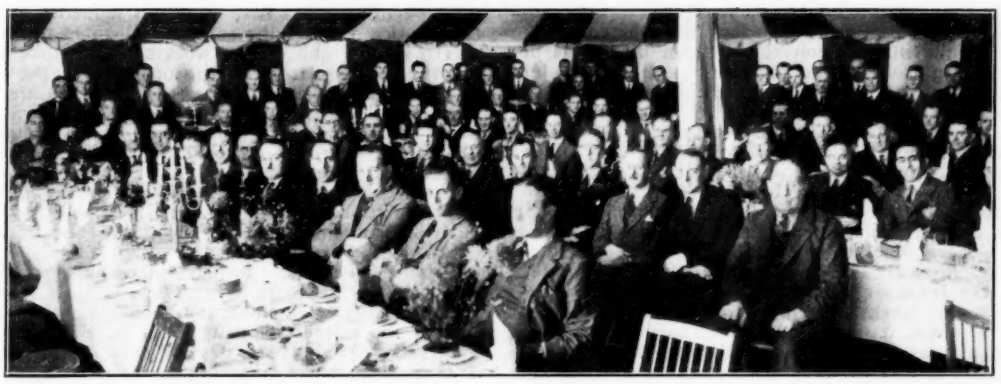
C. H. Kempton & Co., Ltd.
"Kempar" lamp.
"Majestic" lamp, with multiplane reflector.

The exhibits of Messrs. W. Parkinson & Co. were described by Mr. W. G. J. Davey, B.Sc.; those of the Horstmann Gear Company by Mr. Glover Clark; while the remainder were dealt with by Mr. H. H. Thomas, B.Sc., of the Liverpool Gas Company.



The Abertillery Gas Department were successful in winning first prize of a silver cup with the accompanying window display in connection with the local Shopping Week.

Visit to the Works of the Sutherland Meter Company



Over eighty members of the Midland Junior Gas Association visited the works of the Sutherland Meter Company, Electric Avenue, Birmingham, on Thursday, Oct. 18. The workmen had been retained so that the visitors might see the actual process of manufacture, and everyone was impressed by the modern and up-to-date methods adopted by the firm.

The visitors were first taken through the press shop where the various meter pressings were being made, then on to the tin shops, where meters of many types and sizes were in course of construction. The test rooms were next visited. These are very well equipped with scientific instruments for the efficient testing of gas meters. The paint spraying plant was inspected, and, finally, the setting room, where all prepayment parts are inspected.

The method of attaching the leathers to the diaphragm by machinery is most ingenious. This is a step forward.

Great interest was shown in a self-draining dry meter. This meter is so designed that it drains any condensate which may accumulate in the interior back to the inlet main, no syphons being required. The development of this particular type of meter should be of benefit to the Industry.

Following the inspection, the visitors were entertained at Dinner.

Mr. J. H. WAINWRIGHT (the President) in proposing a toast to the Directors of the Company and their General Manager, Mr. C. F. Knight (Past Chairman of the Junior Institution of Engineers), said how much they were impressed by the works and how they realized that the Sutherland Meter Company were well equipped to serve the Industry.

The toast was supported by Mr. F. A. JENKINS (Leamington).

Mr. KNIGHT, replying on behalf of the Chairman and Directors, said how pleased they were to have been able to show the visitors what they were doing.

New Idea for Selling Gas Appliances.

Authorized Dealers' Scheme.

A new scheme for developing the sale of gas equipment has just been started by the Gas Light and Coke Company. There is no limit placed upon the number of selected dealers who can be enrolled in this campaign, but, naturally, they must do business inside the Company's area. Other general qualifications are that the firm should be able to advise and influence its customers in questions of domestic service and to make a good display of the gas appliances. Plumbers, electricians, builders, decorators, ironmongers, general stores, and furnishing houses are among those who have already joined the scheme.

The dealer is only asked to provide the space for display and to take a keen interest in the scheme. He is not required to invest any capital in stock, all of which is provided by the Company. The Company have arranged to lend all the necessary material for displays and demonstrations. The idea is that these authorized shops shall become gas showrooms and have a regular display of gas equipment. There is no restriction as to what type of appliance can be sold—as long as it is in the Company's catalogue the dealer can show it and sell it.

The trader receives a commission on any sales that he makes and on any business he may introduce to the Company's showrooms. If he prefers to make use of the usual gas showrooms, he can take his customers along to the nearest Gas Light and Coke Company's office, and any sale made by the showroom staff will mean a commission for the dealer. All the necessary contract forms for hire and hire purchase business are supplied, and in these transactions the customer pays direct to the Company so that the dealer is relieved of the duty of collecting the money. Traders must quote the Company's prices.

A feature of the publicity service, in connection with this scheme, is a large outdoor sign. This is finished in cream colour with bold lettering in red and black. The slogan is—"Mr. Therm is Here. Get Up-to-date with Gas"—and the board carries a small picture of Mr. Therm as well. This sign is fitted by the Company without any charge. A special display service has been organized and traders can make their choice from several different designs. Dealers are also supplied with illustrated leaflets, booklets, catalogues of appliances, and other publicity material.

More than 150 authorized dealers have already been enlisted in this co-operative effort to make the public more generally aware of the many services gas can offer them. The scheme is resulting in a big increase in the direct contacts with the ordinary householder and the property owner, which are so important for increasing the sales of gas equipment.

A Brighter Birmingham.

New Gas Installations.

Birmingham is to welcome its new Lord Mayor not with a flourish of trumpets, but with a flare of lights.

For some time past the Gas Department has had work in progress on a scheme to improve the street lighting in New Street and Corporation Street by the installation of a modern high-pressure system of gas lighting. As a compliment to Alderman Grey, who was for some time a member of the Gas Committee, it has been decided to inaugurate the new lighting scheme on Nov. 9 when he is to be elected Lord Mayor.

The new lighting scheme will rank Birmingham streets among the best lighted in the country, and it is claimed that New Street and Corporation Street will be the only thoroughfares in England to be graded as Class A of the British Standard Specifications for Street Lighting.

Some indication of the power of the new lighting system will be realized when it is understood that, when only one-fourth of the total lamps are in use, as will be the case after 1.30 a.m., there will be more light than when all the lamps at present in use are in operation. The scheme includes the provision of 50 lamps in New Street suspended on 25 cables at intervals of about 20 yards. Each of the lamps is of over 2,000 candle-power, so that the total lighting intensity of New Street will be well over 100,000 candle-power.

A similar scheme is being installed in Corporation Street as far as the Old Square, but from that point the overhead suspension method has to give place to steel columns erected at the edge of the pavement.

Luton Company Celebrates Centenary

A Hundred Years of Progress

It was during the latter part of 1833 that a few prominent citizens of Luton decided to form a public company for improving the illumination of the town by means of coal gas, and on Oct. 10 the following year a party of friends dined at the George Hotel to celebrate the lighting of the town.

To mark the completion of a hundred years of service to the town the Luton Gas Company are arranging various celebrations, among which are the publication of an attractive illustrated brochure setting forth the main landmarks in the history of the concern from the time of its foundation, and an exhibition of gas appliances.

The first General Meeting was held at the Red Lion Hotel on Thursday, Nov. 21, 1833, but it was not until Feb. 13, 1834, that the tender of Mr. West, of Durham, for the erection of the gas-works, was approved.

On April 17, 1834, it was decided to increase the capital of the Company, by fifty additional £10 shares, to £3,000, and it was on Sept. 25 that the price of gas was definitely fixed at 14s. per 1,000 c.ft.

High Town was not lighted until 1841. To enable the Company to carry their main to that district, the capital was again increased by £2,000, also in shares of £10 each.

The history of the Company as a really successful concern did not begin until the year 1843, when Mr. William Phillips, of Market Hill, was induced to undertake the responsible post of Manager and Secretary of the Company.

The results justified the confidence of the Directors in Mr. Phillips, for from the year 1843 the Undertaking became a paying concern. In his later years he was assisted by his eldest son, Mr. William Richards Phillips, C.E., who succeeded his father and established a reputation for efficiency which was recognized among gas engineers throughout the country. Mr. William Richards Phillips died in 1921, and was succeeded by his son, Mr. William Phillips, the present Engineer and General Manager. So there has been a continuous managership of the Company by the Phillips family for 91 years.

So well did the Company succeed in its endeavours that it was decided on Aug. 5, 1844, to reduce the price of gas to 11s. 3d., and a further reduction was made on Sept. 30, 1846, which brought the price to 10s. per 1,000 c.ft.

The maximum storage capacity at the works in 1846 was stated to be 12,000 c.ft.; to-day it is 2,262,000 c.ft.

Towards the end of 1857, the Company decided to apply to Parliament for Statutory Powers, and the Bill was passed on June 28, 1858. As the use of gas became more popular the quantity manufactured steadily increased. In the year 1858 it was 15 million c.ft. In 1868 it amounted to 36 million c.ft., and the stock of coal was increased from 500 to 1,000 tons. To-day the stock is 14,000 tons. In 1878 the make was 72 million c.ft., and in 1888 it rose to 128 million c.ft. In 1908 over 360 million c.ft. of gas was made.

And so, from that small beginning in 1833, the Company has developed and prospered. To-day there are 14,586 slot meters, 8,194 ordinary meters, and over 47,000 cookers, heating, and hot water appliances in the district, while the quantity of gas sold in 1933 was 3,937,900 therms (803,653,000 c.ft.), an increase over the year 1932 of 100,279 therms (20,465,000 c.ft.), or 2·61%. For the half-year ended June, 1934, there was an increase over the corresponding period of 1933 of 146,642 therms (29,927,100 c.ft.), or 7·4%. During 1933 over 34,600 fitting jobs were attended to; the number of consumers increased by 1,109, and more main and service operations were carried out than in any other year.

The Exhibition.

In further celebration of their centenary the Company have secured the largest hall in the town for a week's exhibition and have set up a very fine display in co-operation with the following: Davis Gas Stove Company, Parkinson Stove Company, W. H. Dean & Co., British Furnaces, Electrolux, Falk, Stadelmann, & Co., and the British Commercial Gas Association.

The hall has been specially lighted by Sugg's overhead gas lamps, while individual directional units are used for the displays arranged round the walls of the hall. In the centre of the hall are several of the individual displays, including the Luton Gas Company's main exhibit. Here an attractive selection of lighting, heating, cooking, and water heating appliances are displayed, and a small section is devoted to showing the various gadgets which may be plugged in to gas. Also shown is a model of the Luton Gas-Works, beautifully constructed to exact scale. This was made by one of the workmen and took over three months to complete. At the one end of the hall is the platform for cookery demonstrations, which are held twice a day, while at the other end, above the entrance door, a huge "thermometer," indicating the rising output of the Company, is thrown into relief by a floodlighting lamp on an adjacent balcony.

The whole exhibition is most attractively set out, and congratulations are due to Mr. G. Wilkes, the Company's Distribution Superintendent, who was responsible for the detail work.

This exhibition was formally declared open on Monday afternoon by Mr. S. H. Whitbread, C.B., H.M. Lieutenant for the county of Bedford, in introducing whom the Chairman of the Luton Company (Mr. R. E. Tomson) gave a few facts regarding the development of the undertaking. A large proportion of their present output, he said, was sold for industrial purposes, for, thanks to their Town Council and their Industries Committee, many large firms had been induced to settle in Luton, which had benefited the Company as well as the town generally. They were celebrating their centenary, added the Chairman, in a permanent way by instituting this year a scheme of contributory pensions and life insurance for all their employees, and he was glad to say that all of those eligible had taken advantage of it. They were holding this Exhibition to give everyone an opportunity of seeing the progress made in late years in all directions. In conclusion, Mr. Tomson said how pleased they were to have with them that day the Lord Lieutenant of their county, their Member of Parliament (Dr. E. L. Burgin), His Worship the Mayor of Luton, together with leading members of the Gas Industry and of their important local industries.

The Lord Lieutenant then declared the Exhibition open, and, in doing so, congratulated the Chairman and the Company upon the magnificent progress that Luton had made in the use of gas and upon the proud future which lay before them.

Dr. E. L. Burgin (Parliamentary Secretary to the Board of Trade) proposed a vote of thanks to the Lord Lieutenant, at the same time bringing to Luton the congratulations of the Board of Trade, whose task included the administration of gas undertakings throughout the country.

His Worship the Mayor of Luton (Mr. G. Wistow Walker) seconded the vote of thanks, which was supported by Sir Francis Goodenough, C.B.E., who said that the prospects of the Gas Industry to-day were as bright as they had ever been. He thanked Dr. Burgin for his presence there, not only personally but on behalf of the Industry.

A Momentous Occasion.

Mr. C. Valon Bennett (President of the Institution of Gas Engineers) said that when Mr. Phillips asked him to visit Luton that day, he replied at once that he would do so, because he appreciated that it was to be a momentous occasion and that the Institution of Gas Engineers—of which he happened, at the moment, to be President—should, if possible, be officially represented at this Exhibition to celebrate the centenary of the Company. He purposely used the words "if possible" because, although it was his desire to accept all similar invitations, it would be realized that time would not permit him to join his friends on every occasion. His presence there was to indicate that the Institution had a very high regard for this Undertaking, its Directors, and its Chief Officer, Mr. Phillips. They, as engineers, appreciated, however, that no matter how brilliant an engineer might be, he could not show his brilliance if his Directors were not helpful. Knowing Mr. Phillips' work as they did, they appreciated that he served a Board who recognized that they were not members of a Directorate merely for the purpose of drawing fees and paying dividends. They had three interests at heart—the consumers, the workpeople, and the stockholders. This was as it should be, for all were essential to the others, and their interests were common.

He would bring these very brief remarks to an end by saying that the Institution of Gas Engineers thanked the Company for the opportunity of being present; it congratulated them upon their past history, and upon the centenary celebrations taking the form they were doing. It also wished the Undertaking and all those connected with it all the joy and prosperity they deserved.

Modern Legislation for the Gas Industry

By **George Evetts**, M.Inst.C.E., M.Cons.E.

No. 1
CAPITAL, DIVIDENDS and PRICE

IN which the Author, believing that legislation relating to the control of the Gas Industry is likely now to remain stabilized for a number of years, reviews and elucidates the position as it affects gas undertakings to-day.

With the passing of the Gas Undertakings Act of 1934, post-War legislation relating to the control of the Gas Industry will probably be stabilized for a number of years. The combined effect of the Gas Undertakings Acts of 1920, 1929, 1932, and 1934 has produced, or will produce, important changes in the powers and obligations of statutory as well as non-statutory Gas Undertakings.

The Various Classes of Undertaking.

In the 1934 Act the term "non-statutory Undertaker" is defined more clearly than has hitherto been the case. It defines these as undertakings engaged in supplying gas to the public, although not authorized by any enactment, other than the Public Health Act, 1875. Thus, a Local Authority supplying gas under the powers of the 1875 Act only is a non-statutory undertaker. There is one further qualification—that if supplying gas is not the primary business of a company or body, then such a company is not deemed to be within the scope of the Act (the qualification does not extend to Local Authorities). In such cases the obligations imposed by the 1934 Act do not apply. Thus, a colliery company supplying gas to a neighbouring village as an incidental to its coking plant would not fall within the scope of the Act.

The Statutory Company can now be defined as (1) Any Company working under the authority of an Act or an Order having the force of an Act; (2) Limited Companies, working under the authority of an Order, whether that Order be one applied for voluntarily or imposed by the Board of Trade under the Gas Undertakings Act, 1929. In the same manner a Local Authority working under an Act or an Order having the force of an Act is statutory.

The Gas Undertakings Act of 1934 divides the Statutory Company into two categories:

1. Thermal unit undertakers, who are authorized by any enactment to supply gas on the thermal basis.
2. Others who have not considered it desirable to make application for therm orders under the 1920 Act, and who, on account of their small size, are saved from the compulsion exercisable by the Board of Trade under the 1929 Act.

The 1934 Act imposes powers and obligations on all undertakings supplying more than a certain quantity of gas, whether these undertakings are non-statutory or are statutory undertakers not selling on the thermal basis.

These undertakings on whom compulsion can be exercised fall within two categories:

1. Supplying more than 30 millions of c.ft. per annum, in which case the Notice can be served by the Board of Trade, although this body is not required to serve such Notice before Jan. 1, 1938.
2. Supplying more than 20 millions of c.ft. per annum, and giving an unsatisfactory supply, in which case the Local Authority makes application for the service of a Notice by the Board of Trade.

This service of Notice imposes on the undertakers the obligation of applying for a Section 10 Order, which should

(*a*) Define the area of supply.
(*b*) Apply the provisions of the Gas Works Clauses Acts, 1847 and 1871.
(*c*) Apply the thermal system of charging for gas.
(*d*) Regulate dividends and price.

In the event of any non-statutory undertaking not making application for such order, then the Board of Trade can issue one having the same effect.

There is one further stage. All non-statutory or non-thermal unit undertakers must supply gas on and after Jan. 1, 1939, at not less than 2 in. pressure in a main 2 in. or more in diameter, and if they have sold more than 20 million c.ft. per annum it must be free from sulphuretted hydrogen.

Non-statutory undertakers which have supplied not more than 20 million c.ft. per annum in any year 1934-1938 inclusive are given one year to conform to the above purity obligation after the year in which 20 million c.ft. is reached.

Following this outline of the differentiation between various classes of undertaking, the object of these articles is to examine the present-day legislative powers of Gas Companies and outline the importance of the powers already possessed by the Industry, at the same time drawing attention to the deficiencies and restrictions. It will be found that, on the whole, the four Acts passed since the War have made a serious contribution towards modernization and simplicity, and have assisted the Industry in rationalizing within itself. There are, of course, onerous restrictions still in force, and at least one important power which has been withheld, but, taking it all round, the average Gas Undertaking cannot complain that it is prevented from developing and carrying on its undertaking in a businesslike and efficient manner.

Broadly speaking, the powers of a Gas Undertaking can be divided into the following sections:

1. Capital, dividends, and nominal price. The term "nominal" applies to the price on which the dividend powers are based, viz., maximum, standard, or basic. This section covers the amount and methods of raising the capital, powers of redemption, dividend limitation, and so on.
2. The provision for maintenance, repair, wastage, and obsolescence, and in this section the powers will be considered in conjunction with the ordinary company procedure as distinct from and in addition to the legislation peculiar to the Industry.
3. Powers of charge, particularly in regard to the freedom relating to tariffs and the consequential effect on dividends.
4. Working arrangements with other Gas Undertakings and of a general nature, bulk supplies, and so on.
5. Domestic and administrative.

Capital and Dividends.

The raising of capital is easier than it was as a result of special and general legislation during the past few years. Except in certain special cases the usual method of raising capital until quite recently was by the Auction Clauses of the Model Bill, and even this method was not particularly onerous. Certain conditions had to be fulfilled with respect to the first auction, but in the event of non-sale the shares could be disposed of under the provisions of the Companies Clauses Act, 1863, by offers to the existing shareholders and the employees and consumers of the Company. This latter provision, however, was not of particular value in the event of the reserve price being in the investors' opinion too high, because such offer had to be made at the reserve price ruling at the auction. As a further facility, however, the Directors were enabled by the same Clause to offer any shares not sold at the auction or by the alternative method at the best price obtainable.

Under the provisions of the 1934 Act, Companies can issue stock without the machinery of the Auction Clauses at a fixed price by obtaining the consent of the Board of Trade, who shall impose such conditions as they shall think fit. The only practical point rising out of these conditions is that the price of issue shall not be lower than 5% under the market price ruling for four weeks preceding the application. Naturally it would not be expected that the

Board of Trade would consent to a price as much as 5% lower than the market price if a better figure could be obtained, and therefore the facility given to the Company imposes no hardship on the consumers. In the event of there not being a recognized quotation or transactions during the four weeks preceding the application, then the Company must produce evidence that the proposed price is a reasonable one. No objection can be raised to this.

The 1934 Act further enables the Company to dispose of stock after the first auction in such manner as it may think best without the necessity of making the offer to shareholders, employees, and consumers at the reserve price as provided for in the Model Bill.

With regard to loan capital, the 1934 Act relieves all Companies of the obligation of issuing debenture stock by public auction or tender.

The Act also authorizes the payment of commissions for absolute or conditional subscription for any share capital to be offered, and this includes the procuring or agreeing to procure subscriptions from other sources. There are two qualifications to this power:

(1) The maximum commission is to be 1½% or more if the Board of Trade will give consent up to 3%.

(2) The amount of the commissison must be disclosed on any document published in connection with the offer.

These powers are in addition to the power which any undertaking may already have to pay brokerage.

The Act further empowers an incorporated company to issue redeemable preference and debenture stock. If before the commencement of the Act the Company has created stock other than redeemable stock, then the authorization of a General Meeting is necessary. By the same Section redeemed stock can be re-issued, and the first schedule of the Act covers the issue of redeemable and redeemed stock. It is to be further noted that the powers conferred by the relevant section are in substitution for any existing powers possessed by such Company.

In addition to the general powers conferred by the 1934 Act, a special provision for the benefit of small investors is a feature of modern Acts and Orders. Under these powers and subject to the approval of a General Meeting, the Company may reserve a proportion, not exceeding one-fourth, of each issue of share capital for exclusive offer to consumers and employees at such price and upon such terms and conditions as to payment as the Directors may prescribe. The price shall be the reserve price at which the remaining three-quarters of such issue is offered by auction or tender. In relation to price, therefore, this falls into line with the model clause, but in the case of the model clause the offer cannot be made until the stock remains unsold after the first auction. A still further power obtainable is in respect of the sale of share capital to employees and consumers at a fixed price. This is in effect adapting the provisions of the Act of 1934 relating to general investors to the particular needs of employees and consumers. This clause is operative before or in lieu of offering the stock for public tender, but the price of issue is not to be lower than the average of the previous six months, and the consent of the Board of Trade is to be obtained.

In the case where Companies have any redeemable stock, there is an equivalent power permitting the purchase and cancellation of the Company's securities. This clause is a feature of modern Acts and Orders, and permits the Company to purchase debentures or debenture stock at the market value and to apply capital moneys for this purpose. Securities so purchased must be cancelled.

With regard to the proportion of borrowing powers in relation to share capital, it will be remembered that the 1929 Act empowered borrowing in some form or other to the extent of 50% of the ordinary and preference capital including premiums. This power was automatic and needed no application to the Board of Trade. The same Act enabled the Board of Trade, on application of the Company, to authorize borrowing up to 100% of the share capital including premiums. Thus the Company's borrowing powers become very elastic, although many people do not agree with the 100% equivalent. The common figure in modern Orders is 60%, because this figure removes doubts raised about priorities when the automatic quota of 50% empowered by section 2 of the 1929 Act is under consideration.

If the full power of 100% is exercised, the Company's capital structure becomes half borrowing and half share capital. If this share capital were divided up between half Ordinary and half Preference, there would be 75% of the total capitalization of the undertaking subject to preferential dividend in some form or other, and this does not seem good enough for the shareholders in a public utility undertaking.

With regard to preference capital, the majority of undertakings seeking fresh powers take the option of raising new money partly by ordinary and partly by preference stock in any proportion which the Company may desire. Preference capital can be issued as redeemable, and the limit of dividend is always sufficient to enable the capital to be raised at par or a premium, with the result that capital is often raised at a considerably less rate of interest than the limiting figure. The same applies to the loan capital.

Summing up the position, therefore, in regard to the raising of capital, the Industry appears to have everything it wants short of complete freedom. Complete freedom would be inadvisable, because the Industry must keep faith with the consumers by preventing their exploitation by doubtful methods. Apart from that it is, partially, the restrictions on the amount and methods of raising capital which enable gas stocks and loans to occupy a place between the best commercial securities and gilt-edged.

Parliament or the Board of Trade are not niggardly in the granting of new capital powers, but these authorities must be satisfied that the amount proposed will not carry the undertaking for more than ten to eleven years. This gives an opportunity of periodical examination of the manner in which the Company has exercised its stewardship.

In the case of application to the Board of Trade it is necessary to provide a statement of the purposes for which additional capital is required, based on some rational method of calculation.

The question of capital consolidation only arises indirectly, but there is no difficulty in arranging for the watering of capital carrying an unnecessarily high rate of dividend, and merging different stocks into one common stock.

It is necessary, however, to satisfy the competent authority that the capital value of the undertaking bears some relation to the new capitalization, and the premiums associated with converted stocks are abolished, because the nominal additions are fairly regarded as taking the place of the premiums in the total capitalization of the undertaking.

Dividend Limitation.

The 1934 Act contains only one important clause in relation to dividends, to which reference will be made later.

The basic price legislation of the past 15 years has had a great effect on the commercial side of the Industry, but the 1934 Act makes no change in the operation of the broad classes of undertakings.

(1) Maximum price and maximum dividends.

(2) Standard price and standard dividends, coupled with the sliding scale.

(3) Basic price and basic dividends.

The new undertaking has a choice of the three methods, whereas the old-established one can change from (1) to (2), or (2) to (3), or (1) to (3). Changes in the reverse direction cannot be visualized; in fact it is doubtful whether such a change should be authorized.

Modern legislation tends towards the basic price system, and in conjunction with comparative freedom in tariff making this method will gain adherents.

It may be assumed that most undertakings are satisfied with the present position in regard to dividends, whatever may be the system of regulation. With regard to new undertakings, the Authorities are not forcing any particular system of dividends in relation to charges, and are prepared to grant the maximum system for small undertakings, and will change these powers for sliding scale or basic at a later stage. As in the past, pioneer capital is granted a higher rate of dividend than money invested recently or to be invested in the future. In the case of maximum dividend undertakers, objection is often raised against a change over on account of possible risk to the stability of the dividend.

If the proposal is to change to the basic price system, these fears are groundless, because the basic dividend can be paid whatever the price of gas may be, and if only the basic dividend is aimed at, then this is equivalent to a maximum dividend built on unlimited price. Methods of change will be dealt with later, but there can be no valid objection to changing from a maximum dividend to a basic dividend system unless there are back dividend authorizations substantial enough to make the prospects of increased payment of value to the shareholders.

There is only a remote possibility of risk in a change from sliding scale to basic price conditions. There is usually a certain amount of complication in equating the existing dividend to that on the basic system, having in mind all the factors, whether or not there is an existing system of co-partnership.

The principle is not difficult; the undertaking must not be substantially better off merely on account of the change of method of dividend calculation. Dividend increases

must be earned, but in fact there are cases where a slight reward has been given to companies who have shown consistently good management in recent years.

Among the points to consider are the following:

(*a*) What part of the dividend shall be basic and what part shall be surplus.

(*b*) Relationship between authorized dividend and dividend paid under the sliding scale conditions.

(*c*) When was the standard price fixed and what reduction would take place on revision.

(*d*) The ratio of consumers' benefit to shareholders' benefit before and after the change.

(*e*) The ratio between the benefits to consumers, shareholders, and workmen.

(*f*) The gross workmen's benefit as well as the increment, in cases where there is a co-partnership system in operation.

(*g*) If it is intended to create a co-partnership fund at once, what is the amount to be aimed at, and where is the payment to come from.

It will be realized that on the last-mentioned depends the basic price, which is the pivot for the calculation of the workmen's share.

When dealing with the workmen's benefit, there is one case at least where the workmen have been omitted from basic price provisions, and it was a case where Parliament was satisfied that the workmen were equally well off under an existing system, which is dependent on the price of gas. This is, of course, an indirect method of including the workmen in the basic price provisions.

Although the standard division of surplus profit is:

75% consumers,
12½% shareholders,
12½% workmen,

there are cases where this proportion is varied, as justified by the conditions, apart from the elimination of the workmen.

If there is no co-partnership or profit sharing scheme in operation, it is doubtful whether a basic price system omitting the workmen would obtain the sanction of Parliament. Therefore the economies in the case of sliding scale and basic companies are shared as follows:

Consumers from 5 parts to 9 parts.
Shareholders 1 part.

In the case of maximum price companies the consumer gets 100% in theory, but the economies are more difficult to obtain, or rather the companies seem more reluctant to call them economies.

In the case of increases in cost of production, the consumer pays 5 to 9 parts to 1 in the case of sliding scale companies. He pays 100% in the case of maximum price and basic companies, with one important reservation in the latter. When the dividend has already been increased above the basic, the increases in cost are borne in the same proportion as the savings, until the price and dividend go back again to the pivot or basic figure.

Therefore it appears that in the case of dividend authorization, legislation provides such flexibility that almost any set of conditions can be satisfied.

Price of Gas.

This will be further examined when discussing tariffs, but at this stage the term " price " will be discussed in relation to dividends.

In the maximum price system the highest price at which any single consumer may purchase the commodity is the limiting factor. The maximum dividend can be paid if earned, but the selling price to any consumer must not exceed the maximum price, and with this exception price and dividend have no relationship as far as authorization is concerned. Therefore, if gas can be sold at the maximum price, or lower, the maximum dividend can be budgeted for, and 100% of price reductions goes into the pockets of the consumers, because there is no further toll for dividends.

If the maximum price is being charged and maximum dividends cannot be earned, then lower dividends are the result of insufficient profit and not on account of the Statute. On the other hand there are some cases where, for political and other reasons, gas is sold at lower than the maximum price and the dividends paid are lower than the maximum; but in the great majority of cases gas is sold at substantially lower than the maximum price and the maximum dividends are paid. This is all the more marked in recent years where many local authorities have not exercised their powers under the Gas Regulation Act with a view to revision of the maximum price.

In the sliding scale system the highest price again rules the dividend. There is no limit to the price in the Statute, although the interesting problem was raised on one occasion whether an undertaking was legally entitled to raise its price above the figure at which the dividend vanished. Take, for instance, a company with a 5% standard dividend with a 2s. 6d. slide and a standard price of twelve pence per therm. This 5% standard dividend would vanish by the operation of forty increments of dividend or 8d. per therm in the price. Theoretically, therefore, if the price were over 20d. per therm the dividend would vanish and become a minus quantity. The suggestion was made that the 20d. per therm was virtually a maximum price. It is clear that this cannot be more than an academic interpretation, because the Company getting to this state would apply for a revision of the standard price.

In the opposite direction it is interesting to note that if the gas were given away in this undertaking the dividend would only reach 12½%. Even at the ridiculously low price of 4d. per therm this hypothetical undertaking could only make 10% profit, and there are many undertakings in similar positions, proving that the Industry cannot very well become profiteers.

However, the important point in this Section is that the shareholders get no accumulation of dividend for selling large quantities of gas at rates lower than the ordinary price for small domestic consumers. It must not be overlooked that in maximum, sliding scale, and basic prices, differentials in outside areas are not taken into account. Neither are hiring rates for prepayment meters and for appliances. In the event of public lighting being sold at a lump sum charge including maintenance, it is necessary to divide the receipts as between gas and service under the basic system. As long as gas was used for domestic purposes only, the potential loss of dividend in having the authorization calculated on the price to ordinary consumers was not important. With the introduction of the basic system by the South Metropolitan Gas Company in 1920, the average receipts for gas became the basis on which the basic dividend was calculated. Therefore, a reduction in price to any particular consumer or group of consumers will bring its corresponding shareholders' portion. In order to protect the small consumer and prevent undue reductions being given to big consumers, new basic price undertakings now have a clause, following the recommendations of the Wrottesley Committee, which limits the shareholders' portion accruing from gas sold at big discounts as follows:

Up to 30% discount, the full authorization;

Over 30% and not exceeding 40%, three-quarters of the authorization;

Over 40% and not exceeding 50%, half the authorization;

Exceeding 50%, one-fourth of the authorization.

In the writer's opinion this is an unnecessary clause, but it does no harm. If an undertaking is budgeting for a certain revenue and its dividend authorization is based upon that revenue, the Company is politically indifferent to whom the reductions are given, and therefore endeavours to reduce the price to those who deserve it, and partly with an eye to increasing business. It is clear, however, that undertakings will not sell at uneconomic rates merely to increase business. The quantities of gas so sold must be increased enormously before there can be any indirect influence on the cost of production sufficient to balance the loss sustained by selling at an uneconomic rate. However, for good or evil the Industry has accepted the clause and, as mentioned above, no serious objection can be made because it is difficult to imagine any combination of circumstances making more than a shilling or so difference to the dividend authorization.

In closing this section, reference must be made to what is known as the South Suburban Clause. But this will be dealt with again under the section on tariffs. The South Suburban Clause embodies the principle involved in the maximum price and sliding scale legislation, that is, the highest price rules the dividend. The Clause provides that, in the event of any gas being sold to any consumer at more than the basic price, the dividend is not to be increased above the basic figure. It was realized that this clause was objectionable, though it was inserted in many basic price Acts and Orders, but the 1934 Act relieves undertakings of this obligation with certain attached conditions.

[In his next article Mr. Evetts will deal with the important subject of Provision for Maintenance, Repair, and Obsolescence.]

OIL FROM COAL

NEW DISTILLATION PROCESS

Last week, through the courtesy of the Directors of the National Coke and Oil Company, Ltd., we were able to inspect the Company's oil-from-coal plant at Cannock—a forerunner, we were told, of others of a similar type to be erected at Edinburgh, Cardiff, Manchester, Birmingham, and on the Thames. To term it a new plant is hardly correct, for it has been in large-scale operation for a long period, has been developed over a period of four years, and has been the subject of exhaustive tests by Dr. C. H. Lander, C.B.E., formerly Director of Fuel Research, and now Professor of Engineering at the Imperial College of Science. The process, which is highly interesting and a distinct departure from normal low-temperature systems, has his blessing from a technical viewpoint, and there can be no doubt that he has great faith in its ultimate commercial success.

The Cannock process has been developed by Mr. W. B. Mitford and his associates over a period of several years, and the Board of the National Coke and Oil Company, in addition to Mr. Mitford, consists of Sir Thomas D. Eldeston, Major E. G. Monro, Mr. Arnold S. Rowntree, and Mr. Corbet W. Woodall.

Carbonizing a Coal-Oil Mixture.

The outstanding feature of the process is that it employs a mixture of coal and creosote. The raw coal is pulverized to a nearly impalpable powder. Actually the coal is a mixture, the present practice being to combine some 60% of non-coking coal with 40% of coking, different coals naturally requiring different mixtures. This blend is then intimately mixed with creosote, or the heavy fraction resulting from the distillate yielded by the plant. In the course of this mixing, a heavy suspension of coal in oil is formed and the charge is ready for the retort.

The retort is of the inclined, cylindrical, rotating type and is externally fired by oil or gas burners, the latter utilizing the gas produced by the carbonization. The rotation of the retort ensures that the contents are in a constant state of agitation, and every face of the finely divided coal is presented to the heat, which is the more readily conducted to it since it is enclosed, as it were, in a conducting vehicle of oil. The effect is virtually that of reducing the coal to a lamina so thin that the non-conductance of the coal is negligible, the lamina being surrounded by a fluid conductor that distributes the heat, and ensures circulation. The working temperature is approximately 450° C.

Owing to the inclination of the retort, the heavy, solid product of the process falls to the lower end, where it is drawn off, cooled, and conveyed to screens, while the volatile fluid vapours rise to the top, whence they pass through condensers to a topping plant of standard design. The yield is a motor spirit of high quality, smokeless fuel, and gas. There is no measurable yield of ordinary tars, and the heavy oils from the distillate are returned to the primary mixing plant where they are combined with coal dust to provide fresh charges for the retorts.

At Cannock, the incoming coal is received on a siding, whence it is elevated to hoppers. The material then passes to the pulverizers and mixers, which are of ordinary standard pattern. The retort is of steel encased in firebrick, and the burners, which operate within close temperature limits under pyrometric control, are readily accessible for inspection and cleaning; provision for alternative firing by gas or oil is provided. An electric drive is used for the retorts, the friction drive, giving a large step-down speed ratio, being adequately compensated on the driving surfaces for expansion of the retort during heating.

At the solid-fuel discharge of the retort, the fuel is received in an airtight chamber where it is cooled before passing on an inclined conveyor belt to screens providing for grading into four different, marketable sizes, ranging from fines to medium-sized lumps. The topping plant which handles the volatile product is of standard design.

Speed and flexibility are features of the system. It is possible to process a charge completely within 2 hours 40 minutes of the receipt of the raw coal at the sidings, including the topping and distribution to the storage tanks.

The motor spirit (" Napet ") has a high octane number, and possesses anti-knock qualities analogous to those of benzole.

The smokeless fuel marketed under the name of " Naco," it is claimed, burns readily and without smoke.

Dr. Lander's Report on the Cannock Process.

From the foregoing outline of the essential features of the Cannock plant, let us turn to Dr. Lander's report of a test he carried out from May 19 to May 26, 1934. It may be mentioned that during the twelve months ended October last, Dr. Lander visited the plant on many occasions, and " during this time it has been run continuously for periods up to six weeks in duration and has only been stopped from time to time to make alterations which have effected improvements in the quantity and quality of the resulting products. It has run smoothly, and such few compulsory stoppages as have occurred have been due to unimportant defects in the auxiliary apparatus."

" For the purpose of our test," continues Dr. Lander, " a blend of Staffordshire coals was used which, after pulverizing, was ultimately mixed with distillate which had previously been through the process, together with fresh industrial creosote regularly added in the proportion of 8% of the total oil.

" This mixture was fed to the heated revolving retort in the manner which has been practised in the past nine months. The following is a detailed statement of the results from this run [May 19-26, 1934] made under our continuous observation:

Number of hours running	140	
Total coal processed	143·9	tons (colliery weights into bunkers)
Total creosote added	2,710	gallons
Total yield of petrol	2,192	,,
Total yield of smokeless fuel	112	tons
Amount of petrol (washed and ready for local market) per ton of coal processed	15·3	gallons
Amount of smokeless fuel per ton of coal processed	15·6	cwt.
Oil produced (free from petrol)	655	gallons
Stoppages	A few hours in topping plant, and 7¾ hours in retort-house on account of pump breakdown.	

" Under the process, as operated under our observation at Cannock, I hereby report that raw materials in the proportion of 1 ton of coal fines together with 18·9 gallons of industrial creosote were mixed with sufficient coal distillate previously produced by the plant to bring the resultant mixture to approximately 50% solid coal to 50% liquid. There were produced 15·3 gallons of motor spirit ready for sale to local garages, 15·6 cwt. of smokeless fuel, and 4·5 gallons of heavy oil. The heavy oil is ready for immediate re-use with further coal fines without any treatment.

" The amount of gas produced was insufficient when burned to provide the bulk of the heat required for heating the retorts wherein the reaction takes place.

" It is my considered opinion, based upon a critical study of the process, that this quantity of 15·3 gallons of high anti-knock value petrol could be increased, and an even higher grade of spirit produced by a more efficient condensing system and certain simple modifications in the topping plant.

" The throughput of coal dealt with by the retort during the test amounted to 24·6 tons per day. At a later date a throughput of 37 tons per retort per day was obtained over a run of three days' duration.

Note.

" There are four outstanding features in regard to the Cannock Process which differentiate it from normal low-temperature carbonization. These are as follows:

(1) " The possibility of obtaining 15 gallons or more of motor spirit by processing raw materials consisting of coal to which 18-19 gallons of creosote per ton has been added.

(2) " The production of approximately 15 cwt. of smokeless fuel from the above raw materials.

(3) " No deposition of tars or pitches at any stage in the process.

(4) "No apparent deterioration in the qualities of the oil, which, after having the petrol removed, is returned to the plant for mixing with further coal fines, thus obviating the necessity for using fresh creosote, other than the make-up of 18 gallons mentioned above."

Prior to the inspection of the working plant at Cannock a luncheon was given by the Company, to which many representatives of the Technical and Daily Press were invited.

Mr. Arnold Rowntree, who presided, spoke of the potentialities of the process in giving employment to the miners, alleviating suffering in the distressed areas, and benefiting the nation by helping to remove the pall of smoke which was admittedly highly detrimental to health. The social aspect of smokeless fuel and the national aspect of home produced petrol were also the kernel of remarks by Prof. Julian Huxley, the distinguished Scientist. Earl Howe, who had driven from London in a car using "Napet"—and, by the way, had not travelled slowly—paid glowing testimony to the merits of the spirit, while Captain E. W. Percival mentioned that he had flown from Gravesend to Birmingham in a matter of 48 minutes—on "Napet."

From Agnosticism to Belief.

Prof. Lander left no one in a quandary as to his views on the Cannock process. Over a period of fourteen or fifteen years, he said, he had had a wide and bitter experience of plants designed to produce petrol from coal; and had it not been for the nature of the claims of Mr. Mitford for the Cannock plant he would not have considered examining it. He approached the matter as an agnostic, and had been given a free hand. That was twelve months ago. The plant at Cannock was a full commercial unit, and from each ton of coal processed—with 18 gallons of new coal oil added to the mixture of coal and creosote—were produced 15 cwt. of good smokeless fuel and 15 gallons of petrol.

Mr. Mitford pointed to the important fact that the units, which were standard to deal with 150 tons of "mixture per day," could be installed and worked anywhere; and he looked forward to the time when every city would have its own plant.

The Science and Practice of Gas Supply*

By Arthur Coe.—Volume I.

Reviewed by E. W. Smith, C.B.E., D.Sc., F.I.C.

All the signs indicate that the Gas Industry is at the present time going through a process of more or less controlled but rapid state of evolution. This applies technically and commercially, and also from the still more important point of view of broad administration.

In recent times a great deal has been said about the importance of salesmanship, and to-day it is fair to say that more attention is being given to this branch of the Industry's activities than to any other, although nothing would appear to be seriously neglected in other directions. Nevertheless it would be unwise to slacken in any way the developments that are possible on the technical side. The good salesman will be cramped in his efforts if the product he is to sell is not the best of its kind and produced at the lowest cost.

The processes of gas manufacture have been developed to a high state of perfection. This includes as it should the methods of gas treatment on the works. The technique has been systematized, and the training which a rising generation has at its disposal is specific, and of a scientific type.

Perhaps of as much importance and by no means secondary is the subject of gas supply, which should include distribution and all the applications of gas. This branch of our Industry has not, to date, been sufficiently systematized to justify its being termed a science. The teachers of this subject have had nothing of very much value to assist them. Each in his own way has translated practice into teaching, and there has not been sufficient uniformity. Complete uniformity is not advisable or useful, but until there is more of it the subject of gas supply cannot truly be said to be a science.

Education, training, and experience are the foundations of all sound development, and the present writer is of the opinion that no one in this generation has made a greater contribution to the technique of the Gas Industry than Mr. Arthur Coe in the work he has done in the preparation of the first volume of "The Science and Practice of Gas Supply."

This is a voluminous text-book prepared as a result of the author's own experience within the Gas Industry and as a teacher in the closest collaboration with many other teachers and experts in individual sections of the subject.

If Volume III. maintains the standard of Volumes I. and II. then the complete work, extending as it will to approximately 1,500 pages, will undoubtedly furnish the only complete text-book available, not only to students, but to those who are engaged in the study of gas supply who have not had the opportunity of a systematic course in the subject. The author is a psychologist who understands the type of student who is desirous of studying the subject dealt with. It is certain that some critics will express the view that the author has elaborated some of his sections to too great detail. After reading the book thoroughly, and submitting it to experts on a number of the sections, the present writer believes that he would not have the book any different in its broad method of treatment of the subject.

There is, it is true, a certain amount of repetition, but this is necessary from the point of view of clarity when it is realized that it is the student who will use it. Anyone who seriously uses the book as a text-book, and has the opportunity of obtaining practical experience, will develop an outlook and a state of mind which will help him to appreciate the subject as a whole in a way which should prove quite different from any other method.

Those of us who have done a fair amount of teaching, and have had to go through the grind of studying new subjects, know how important it is that early conceptions on broad lines should be correct. If that condition is attained then most of the difficulties of any subject disappear.

It is inevitable that a certain amount of prejudice will arise because the book has been published by The Gas College, Halifax. There is a difference of opinion within the Industry as to the utility of correspondence courses. Not only does the present writer believe that a correspondence course is better than no course at all, but he is fairly of the opinion that a good correspondence course, combined with practical experience, is frequently very much better than the average courses which are available at the Evening Schools of the country. This would seem to be confirmed by the fact that on examination of the statistics available of the successes in the Institution Examinations, the students who have availed themselves of the facilities of the Gas College have, comparatively, done remarkably well.

The author has been wise in refraining from falling into the danger of endeavouring to make his students either complete chemists, complete physicists, engineers, or even gas engineers. He has confined himself to an adequate treatment of the subject of the science of gas supply.

In this communication the writer does not propose to go into a detailed discussion of Volume I., but will reserve that for a further communication when discussing all three volumes together.

The book can with advantage be used by all students of the subject. It is hoped that the teachers of the country will be sufficiently broadminded to adopt it. It should be found in every technical library where any pretence is made to supply the requirements, so far as text-books are concerned, of the Industry, and no gas undertaking should be found without one or more copies on their shelves.

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* "The Science and Practice of Gas Supply," by Arthur Coe., Vol. I. Price 42s., post 1s. extra.

Gas in Industrial Design Exhibition

Striking Display by Gas Light and Coke Company

Much interest is being aroused in London at the present moment by the Exhibition of Practical Progress in Contemporary Design, which opened at Dorland House, Regent Street, last Thursday. The keynote of this Exhibition seems to be that feeling of brightness and enthusiasm that accompanies escape from industrial depression. For Great Britain, more perhaps than any other country, is able to show what revival means to design and the standard of living.

The objects of this novel effort are fivefold—good design, good construction, good health, good enjoyment, and good living—and all of these are put into practice in units of five which make up the displays. There are all types of modern rooms—five living-rooms, five bedrooms, five kitchens, five bathrooms, and so on, together with five shops containing the latest designed things that can be bought in them. In addition to these examples of contemporary idealized houses, the rooms are designed in actual size to show the best of contemporary taste in furniture, decoration, lighting, heating, and general equipment.

Having thus briefly outlined the main lines upon which this Exhibition is set, we may say that many interests will be aroused—for designs for living cover a wide field—and it is therefore gratifying to note the presence of gas appliances in their most modern and artistic forms. The Gas Light and Coke Company have put up a fine show on behalf of the Industry, and have effectively indicated the part that gas is prepared to play in the home of the future. The Company have secured a large area for their display, and have obviously expended considerable care in the choice of gas appliances, which, by reason of their utility, design, and finish, are likely to make a definite appeal to those upon whom falls the task of designing and selecting the equipment for the house of to-morrow.

The Desire for Colour.

As regards the gas apparatus shown, two main points make themselves evident—namely, the increasing trend towards colour and the growing appreciation of the space-saving advantages of built-in appliances. The Gas Light and Coke Company are making a particular point of the wide range of colours in which they can supply gas fires, and they have published a very attractive little folder illustrative of the different finishes available, featuring "Mr. Therm, the artist" and his palette. Brightly coloured and stainless steel finishes add to the already pleasing designs of modern gas fires, and it is worth noting that at this Exhibition there is not a black fire to be seen. If there were a more general tendency on the part of the Industry to follow this example of eliminating black finished fires from their displays (as the Tottenham Company, save for one single model, did at the North London Exhibition, dealt with in last week's "JOURNAL"), it would do much to enhance the prestige of the gas fire in the home.

This trend for colour is predominant throughout the whole of the Gas Light and Coke Company's display at this Exhibition. The cookers are shown in beautiful mottled, and green, blue, primrose, cream, and white finishes, and are all complete with thermostatically controlled ovens and "gas matches" for igniting the burners. The washboilers are in grey mottled enamel, while drying cabinets, refrigerators, and water heaters are in white porcelain enamel.

The convenience of plugging-in small gas apparatus is also demonstrated in the display, and here again colour finishes are prominent; even the modern gas iron has a pleasing coloured enamel finish, while stainless steel is used for the gas kettle, bowl heater, dish-warmer, and many other small appliances. On a counter which displays all the latest gas literature and particulars of individual appliances are examples of the most modern form of gas table lamp, with coloured base, chromium-plated column and gallery, and Vitreosil heat-resisting globe. There is an interesting point in connection with the flex which supplies these table lamps and, indeed, any type of standard lamp—and that is that what has hitherto been regarded as an unattractive adjunct to an otherwise beautiful fitment—namely, the black flex—is now obtainable in a coloured finish to match the lamp or the decoration scheme. This is, in fact, all part of the prevailing policy of the Company to supply, within the bounds of practicability, any colour finish or particular design of appliance that any consumer may desire.

An Interesting Kitchen Setting.

Included in the Gas Light and Coke Company's display is a useful idea for a kitchen setting in the very small maisonette or labour-saving flat. This comprises the "Minette" gas cooker alongside the sink, with its back splash-plate capable of being lowered in the form of a draining board, as we described for the first time at the North London Exhibition. In addition, there is a convenient little gas sink water heater, and, built-in with a row of kitchen cupboards immediately above the setting is a small gas-operated refrigerator. The whole makes a space-saving composite setting, both pleasing in appearance and utilitarian in design.

The various classes of appliances in the display are separated into well-illuminated alcoves; while one section of plain wall space is covered with photographic impressions of various gas-works plant, each photograph forming a square, as it were, of a gigantic graph, across which a bright blue line traces the progress of the Gas Light and Coke Company in millions of c.ft. output from early days up to the present time. There is, in addition, a section of a 300,000 c.ft. per hour gas main, with cut-off valve, such as is used in the Company's area of supply, while a gas meter with glass casing shows how the mechanism operates. For visitors of a technical turn of mind a series of blue prints shows diagrams and cross sections of the various gas appliances exhibited, indicating the gas, air, and water ways, burners, &c.

In another section of this Exhibition is an all-gas model kitchen designed by the Gas Light and Coke Company, which again shows the value of gas for supplying the essential domestic services. This room gives all the advantages of the large kitchen, yet packs everything neatly into a limited area. The G.L.C. gas cooker in grey mottled enamel finish fits compactly into a corner; there is a gas sink water heater, and the gas wash-boiler when not in use stands out of the way under the draining board. Built-in cupboards, plenty of shelf space, and service hatch are incorporated. The gas lighting is very effective, comprising a specially designed opal globe fitting and ceiling plate all in one, set directly in the ceiling and switch controlled from the door. Outside the door is an example of a specially designed built-in gas meter cupboard, conveniently situated for easy access, yet well out of the way above a built-in hall cupboard. An adjoining room shows an example of a small gas wall bracket in chromium-plated finish suitable for small rooms or lobbies. A further lighting fitting similar to that in the model kitchen is shown outside these rooms.

It is interesting to note that in another small apartment, designed by Mrs. Darcy Braddell for the use of the maid, is a "Portcullis" gas fire, a gas iron, and a gas drying cabinet built into a cupboard setting. It may be mentioned that the Exhibition restaurant is served by an all-gas kitchen.

All-Electric House.

The all-electric mechanized house included in the exhibition is worthy of inspection if only to appreciate the risks that it is possible to run in the choice of domestic equipment. The present generation is probably used to the vicissitudes of electrical distribution which may suddenly deprive the consumer of his means of lighting, cooking, heating, and cooling all at once. But if he is dependent upon it also—as, according to a Press report, this "model" house shows to be possible—for opening and closing his windows, and, indeed, moving whole walls, he may well be in a sorry plight in the event of the all too liable breakdown. To be able to close one's windows by the mere depression of a switch may have its advantages, but to have a whole wall in the wrong place when the current fails may prove—to say the least of it—inconvenient.

Seriously, however, though one could have hoped for a greater general use of gas appliances at this Exhibition, compensation lies in the very attractive choice which has been made and the pleasing settings in which they have been displayed. We feel that in the gas display, were it possible, many more appliances might with advantage have been connected up—for very few are actually working—to indicate to the public how they look in operation. But, nevertheless, the Gas Light and Coke Company have succeeded in putting up a very effective display, and those responsible are to be congratulated upon showing once more that gas is the fuel of the future.

London and Southern District Junior Gas Association

Opening Meeting and Presidential Address of Mr. F. C. Smith

The opening meeting of the London and Southern District Junior Gas Association was held on Oct. 19 at the London School of Hygiene and Tropical Medicine, W.C. 1—Mr. H. C. SIMS (South Metropolitan Gas Company), the retiring President, occupying the chair at the outset.

The minutes of the previous annual general business meeting having been read and confirmed, Mr. SIMS called upon Mr. R. J. Milbourne to present the Milbourne Medal to Mr. L. T. Minchin, B.Sc., of the Gas Light and Coke Company, for his paper entitled "Principles of Modern Lamp Design." They were very pleased, added Mr. Sims, to have Mr. Milbourne with them on that occasion. He had always taken a great interest in the Junior Associations, and they much appreciated his presence.

Mr. R. J. MILBOURNE said that it gave him great pleasure to visit their Association once again; and he felt that keeping in close touch with the Junior Associations helped one to forget the many years which had passed. He had been connected with the Industry for many years, and he closely read all the papers which Juniors presented; he felt quite sure that they were of great value to the Industry in general. Mr. Minchin's paper would prove very useful at the present time, when the Industry, particularly in the provinces, had to fight very hard to retain the lighting load. And it was most important that the Industry should retain it, as it was excellent propaganda to have the streets illuminated by gas. Many of the smaller undertakings in his own part of the country had lost much of their lighting load as a result of severe electrical competition; and that competition could be met only by using the very best possible lamps which were obtainable and by service which must be efficient and regular. It was therefore with very great pleasure that he asked Mr. Minchin to accept this Medal with the donor's best wishes for his future success.

Mr. MINCHIN briefly acknowledged the presentation.

The New President.

Mr. SIMS said that the time had now arrived for him to vacate the Presidential chair in favour of Mr. F. C. Smith, of the Gas Light and Coke Company. In introducing him to them as President for the coming year, Mr. Sims could only say that the Association could not have made a better choice. Mr. Smith was well known to all of them, and they all knew of the work he had done and was doing for the Industry. His help and advice on the Council of the Association had been invaluable, and under his guidance they were going to have a most successful session.

Mr. F. C. SMITH then took the chair, and in doing so he thanked the members for the very great honour they had done him in electing him President. He would do his best to serve them. He was glad to feel that his first duty was the most pleasant one he could wish to perform during his year of office. It was his privilege to ask Mr. Sims' acceptance of a memento of his year of office. His engineering skill and technical ability were so well known and appreciated in the Industry as to make any reference to these entirely unnecessary. Those of them who had served the Association under Mr. Sims' leadership in Council knew how much the London and Southern Juniors owed to his thoroughness and able guidance. But he knew that when all their efforts to make progress along the road of technical advancement had been forgotten like so many milestones passed along the highway, they would ever remember with gratitude that they were honoured with the friendship of Mr. Sims. Might that friendship be long continued. He asked his acceptance of this gift and with it their sincere thanks and heartfelt good wishes.

Mr. SIMS, in thanking them for the gift, said that his year of office as their President had been one of the greatest pleasure to him, and he was proud that they had honoured him by choosing him for the highest position that the Association could offer. During his year of office he had had nothing but the most loyal co-operation, help, and advice from all his colleagues on the Council, while their Hon. Secretary, Mr. F. H. Higton, had been his guide, philosopher, and friend. He sincerely hoped that the past session had been one not only of instruction but also of pleasure to the members.

The PRESIDENT then offered congratulations to two members of the Association who had obtained the First-Class Diploma of the Institution of Gas Engineers—namely, Mr. B. W. Dawkins, of the Gas Light and Coke Company, and Mr. C. F. Petersen, of the East Grinstead Gas and Water Company—and, for obtaining a Second-Class Diploma, to Mr. R. B. Tunstall, of the Tottenham and District Gas Company.

He went on to call members' attention to the new class of student membership which the Association had introduced. They had been desirous of helping students, and they would now issue tickets at the price of 2s. 6d. a year which would enable students to attend their meetings and take part in the discussions. It was regretted that they could not yet extend this privilege to enable them to take part in the Association's visits. Their Assistant Hon. Secretary (Mr. G. Gardiner, of Wandsworth) was responsible for the working of this scheme.

Mr. SMITH then delivered his Presidential Address, the first part of which will be found on succeeding pages.

THE PRESIDENT.

F. C. SMITH, F.C.S., of the Gas Light and Coke Company.

Mr. F. C. Smith studied chemistry at the Regent Street, and physics at the Chelsea, Polytechnics respectively. During the war he served in the Chemical Section of the Royal Navy. An Associate Member of the Institution of Gas Engineers, he is also a Fellow of the Chemical Society, Member of the Society of Chemical Industry, Fellow of the Physical Society, and a Member of the Illuminating Engineering Society. In 1928 Mr. Smith was awarded the Bronze Medal of the Institution of Gas Engineers for a paper entitled "Some Aspects of Corrosion in Gas Supply Practice" which he delivered before the London and Southern District Junior Gas Association. In 1932 he gave a paper on "The Planning of Gas Installations to Conform with B.S.S. for Street Lighting" before the Institution of Gas Engineers. As well as having been associated, since its inception, with the organization now at Watson House, Mr. Smith is a Member of the Joint Lighting Committee of the Institution of Gas Engineers, and has been associated with the Westminster Technical Institute as a lecturer in Gas Supply and Laboratory Practice for a number of years.

Modern Research Work and its Application in Practical Gas Supply

Presidential Address of F. C. Smith, F.C.S., Assoc.M.Inst.Gas E., of the Gas Light and Coke Company

London and Southern District Junior Gas Association, Oct. 19, 1934.

Before developing the subject of this address, I should like to place on record my appreciation of the honour conferred upon me by this Association in electing me to the office of President for this year. I am called upon to follow men who have graced the office by their personality and leadership, and left us their debtors. If I can maintain the standard they have achieved, you will have no cause for complaint, and I shall be able to look back on my year of office with pleasure and satisfaction.

The choice of subject matter for a presidential address is always difficult, and it was only after considerable reflection that I decided to say something about modern research, and its application to our Industry.

I was led to make this decision for the following reasons:

(1) My own work perforce brings me into contact with much of the work being done both within and outside the Gas Industry.

(2) I believe that all our members will be more or less familiar with work done within the Industry particularly in this country. Our own Technical Press gives us little excuse for being in ignorance.

I am doubtful, however, if the knowledge of the work carried out by organizations not directly linked with our activities is so complete. One may have to wade through numbers of publications in order to find matter directly applicable; but, nevertheless, I would enter a plea that we should know at least the general trend of scientific thought and development upon subjects likely to make contact with our own business. It is salutary to know the point of view of those competent to express an opinion who are able to take a detached view.

Investigations of this kind may shape general opinion and create a public demand that problems relative to health and the like should be viewed from a standpoint differing from accepted views in any given industry. If we are aware of these developments our Industry can contribute its quota to the general well-being and be in the forefront in putting into practice well-established principles. It is for this reason that I have reviewed at some length in this address modern work in comfort conditions.

This must only be regarded as an illustration of much of this type of work with which I believe we should be in the closest touch.

The work undertaken relative to Building Research by D.S.I.R. is another illustration. The name, Department of Scientific and Industrial Research, is indicative that industry should apply the results to industrial problems. Familiarity with investigations undertaken by the academic workers as well as work carried out by organized bodies constituted for the purpose may often save time and expense in re-traversing ground previously surveyed by those having greater facilities than we possess.

When considering the subject, I soon became conscious of the magnitude of the task, and it was evident that only a few aspects of the research which has been undertaken, or is in progress, could be considered.

I have selected for review those aspects of modern work which are perhaps of the more immediate consequence to the Industry, and it is hoped that the subjects chosen may be wide enough to provide some points of interest to all our members. To our more junior members, the references given may indicate the direction in which they may look for publications likely to be helpful to them in their careers. You will soon discover many notable omissions, as whole aspects of our business have been entirely neglected.

This is notably the case in reference to the industrial applications of town gas, although it may be mentioned that the matter relative to burner design, gas quality, and combustion has an important and direct application in this field.

References to your programmes will indicate that some of these omissions will be provided for by the authors of papers to be given during the session.

I have, therefore, limited this address to the following subjects:

1. The external corrosion and protection of service pipes.
2. Burner design.
3. Gas quality.
4. Combustion.
5. Space heating and comfort conditions.
6. Lighting.

I should like to thank the Governor and Court of Directors of the Gas Light and Coke Company for the facilities they have accorded me in the preparation of this address.

Corrosion of Mains and Service Pipes.

It is usual to regard internal and external corrosion as two distinct aspects of this problem, and in all cases, except the internal corrosion of water mains set up by impressed currents, this is logical. I shall not concern myself with internal corrosion in this address as with the advent of gas-drying this has ceased to be a matter of any great importance. It is true that carbon monoxide does react to form carbonyls in the absence of water vapour, and although this may on occasion cause some trouble, the phenomena is well understood, and can be dealt with.

External Corrosion.

This subject can be considered with advantage in relation to the two principal causes:

(1) Corrosion due to impressed currents commonly referred to as electrolysis.

(2) Corrosion due to the peculiar physical and chemical properties of the soil either near to or at some distance from the pipes. Water flowing through such soil rich in soluble salts or of an acid nature may drain from considerable distances to the bed in which the pipe is laid.

All corrosion problems may be studied from these points of view:

(1) Elimination of the agent causing corrosion.
(2) Choice of a material capable of withstanding the agent responsible for the corrosion.
(3) Use of protective materials.

Soil Corrosion.

It is apparent that it is practically impossible to protect pipes by removing the corrosion agent in the soil; the best that can be done is to provide a good drainage bed immediately round the pipe in order that water may drain away freely and thus prevent the pipe lying continuously in water containing dissolved electrolytes. The matter is complicated further in this respect by the fact that no very clear correlation between soil characteristics and pipe corrosion has been established.

A paper by Denison, "Correlation of Certain Soil Characteristics with Pipe Corrosion," reported in *Journal of U.S.A. Bureau of Standards* (Vol. 7, 1931, page 631), is of great interest in this respect. In this paper a very extensive research has been reported and attempts were made to correlate both the *p*H value of the soil and the amount of soluble matter present with the corrosive power of the soil. There is some correlation, but it is not, in my opinion, definite enough to allow an engineer to determine these characteristics for the soil in which pipes are to be laid and to estimate with any great degree of precision what the life of the pipeline is likely to be, or to decide whether it is an economical proposition to protect the line.

In the collected researches of the U.S. Bureau of Standards for 1931 and 1932 four papers were published dealing with various aspects of this subject, which are worthy of the closest study.

Choice of Material.

An extensive search into the work done on the relative corrodibility of the various suitable ferrous materials for

service pipes, and some extensive work done by Watson House (to be published later) has led us to believe that the way out does not lie with the choice of material.

Protection.

A great deal of work has been done in Germany (see Dr. Beck's recent paper read before the Institution of Gas Engineers) and in the U.S.A., as well as in this country (see report of Corrosion of Pipes Committee, Institution of Gas Engineers), on the subject.

In this country it is generally held that a good protective coating should have the following characteristics:

(1) High electrical resistance which should remain as far as possible unimpaired even if the pipe is laid under water. It is presumed that if this condition is fulfilled, water and the accompanying dissolved matter will be kept from the surface it is desired to protect.
(2) The coating should be without action on the pipe, and the adhesion between the coating and the pipe should be greater than between the soil and the coating. The soil must not rot nor otherwise disintegrate the coating.
(3) The coating should not be so brittle as to be removed from the pipe by any mechanical shock within reason, and should permit of cartage without mechanical damage. The coating should not flow from the pipe under the temperature which may be experienced during transit or prior to installation.
(4) The coating shall be of such a nature that joints can be protected without damage to the remainder of the coating.

These are difficult conditions to meet, and one would like to pay tribute to the work the various makers have done in this connection. Not only have the materials used to be carefully specified and the quality of these materials to be controlled, but extensive and expensive plant coupled with the most careful supervision is necessary if the desired product is to be marketed. The Gas Light and Coke Company are buying coated pipes maintaining a resistance well above 20,000 ohms sq. ft. even after periods of over 400 hours' immersion in water, and these pipes show very high resistances even after severe blows from sharp-edged tools.

It is probable that wrapped pipes of this quality are to be preferred to pipes laid in pitch troughing, although if this is well done the protection is all that can be desired. Unfortunately, however, this work has often to be carried out under difficult circumstances, and even with the most conscientious effort by the service-layer the protection afforded may be poor. I would like to say in passing that extended field tests have led us to be confident that pipe coatings maintaining a high electrical resistance behave satisfactorily in practice. This is a valuable fact to have established, as one can test for electrical resistance under prescribed conditions before the pipes are laid, and be assured that they will satisfy practical requirements when laid.

Electrolysis.

The amount of metal removed by this cause is definitely related to the current carried by the system, the damage at any one point is proportional to the current density of the current leaving at the point in question. The effect of increasing the resistance of the distribution system by using pipes covered with high resistance coatings must be to reduce the amount of current carried, and thus to reduce corrosion on this account. High resistance coatings are often used for extensions to existing systems which may be in the main unprotected. Under these circumstances, the usual precautions against damage due to electrolysis must be taken.

In districts where street railways having the return to generator through the running rails are established, it is often a wise precaution to have an electrical survey made from time to time in order to ensure that the electrical regulations controlling these railways are complied with. Where new mains are contemplated in these areas, the prevailing electrical conditions should be ascertained before commencing the work.

Design of Burner.

Whether it be of the bunsen or luminous type the heart of a gas appliance is the burner. Some consideration is necessary in deciding which is the more suitable type for the appliance in question. A few years back the luminous burner was regarded as practically obsolete; to-day for many purposes it is preferred.

In consequence of the luminous burner falling into disfavour little work was done to improve the design or to impose the necessary limits upon the important dimensions.

With an increasing field of usefulness it has become important to modify design for certain purposes and to seek a higher standard of precision in regard to dimensions.

Physics and Design of Bunsen Burners.

This is a complex and difficult subject, and it is to this type of burner that research has in the main been directed. I propose to call attention to the work done in this field, and I trust the brief review possible under the circumstances may be helpful.

A great deal of the work to be referred to has been done on cooker hotplate burners, but the general findings are in the main applicable to all classes of bunsen burners. It may be helpful, however, if we fix our attention on cooker burners always bearing in mind the more general application.

Requirements of a Good Burner.

(1) The burner must be stable in action over the whole range of B.Th.U. rates for which it is designed.
(2) When associated with its housing, and performing the work for which it is designed, the combustion of the gas must satisfy modern standards (see section dealing with combustion).
(3) The efficiency of the burner must be as high as is consistent with other requirements and the maximum B.Th.U. rate for which the burner is designed must permit of rapid service to the customer.
(4) If required to operate in various parts of the country on gases of differing calorific value, or on gases of differing specific gravity, the range of adjustment permitted by the gas and air regulators must be adequate.
(5) If designed to operate with or without gas and air regulators on a gas of given calorific value, it must satisfy requirements (1), (2), and (3)—even when the specific gravity of the gas varies within reasonable limits.

It is recognized that the economic manufacture of the gas, so essential in the interests of the consumer, may necessitate changes in specific gravity and composition of the gas, and that a well-designed burner should be able to cope with such variations providing they are kept within reason.

I would urge in this connection that:

(i.) The designer should make the burner to operate over as wide a range of gravities and compositions as is consistent with the highest service to the customer, and should inform the gas engineer of these limits.
(ii.) The gas engineer should maintain the specific gravity and composition as constant as economically possible, but under no circumstances should he permit variations outside the limits imposed by the most sensitive apparatus on the district. As a general rule, it is my experience that lighting burners are a very good index to permissible variation, and I know of undertakings which adopt these burners as the criterion.

It cannot be too strongly emphasized that the more constant the specific gravity and the composition of the gas, the better will be the performance of well-designed appliances arranged to operate on the gas in question.

Having set out the requirements of a good burner, I think it is easier to appreciate the various factors which affect the performance, and which have had to be investigated by research workers in this field.

Work of Gas Investigation Committee of the Institution of Gas Engineers.

The work of this Committee has been reported at length in our own Technical Press, and one has therefore assumed that members are at least familiar with the general conclusions. The ninth report is of especial interest as it deals with the effect upon burner performance of changes in—

(*a*) dimensions of burner tube;
(*b*) size and type of injector, and direction of injection;
(*c*) size of burner ports;
(*d*) calorific value, composition, and viscosity of the gas.
(*e*) B.Th.U. rate;
(*f*) specific gravity of the gas;
(*g*) injector pressure.

Bearing in mind the many and varied requirements a good burner must satisfy, and the number of factors affecting performance, it will be appreciated that any such investigation is complicated and difficult.

A great deal of systematic work in this connection has

been carried out in America under the auspices of the U.S.A. Bureau of Standards, and the American Gas Association, and as I believe this work may be unknown to some, a brief summary may be helpful.

The work referred to is published in four papers bearing the following titles:

(1) Design of Atmospheric Gas Burners, 1921.
(Bureau of Standards Technological Paper No. 193.)

(2) Relative Usefulness of Gases of Different Heating Value and Adjustments of Burners for Changes in Heating Value and Specific Gravity.
(Technological Paper No. 222.)

(3) Bureau of Standards Circular 394.

(4) Method of Determining the Most Favourable Design of Gas Burners.
(Bureau of Standards publication R.P. 446.)

Before proceeding to discuss these papers, I should like to refer to work conducted by my old Chief, Mr. J. G. Clark.

Mr. Clark was concerned with establishing the permissible variation in the specific gravity of the gas consistent with satisfactory service to the customer. The work is of especial interest to us because of the experimental methods adopted. In previous work of this nature it was customary to compute the air-gas ratio of the burner mixture from analyses of the gas, and the air-gas mixture. Mr. Clark was able to establish very important facts relative to the effect upon air-gas ratio of supplying the burner with gases of varying specific gravity by a method involving the measurement of the suction on the burner tube at a point near the injector. As far as I am aware, this was the first time that pressure measurements were used in order to study the physics of the bunsen burner.

Fig. 1 is a curve plotted from the results obtained. It is clear from this curve that the suction at a point in the

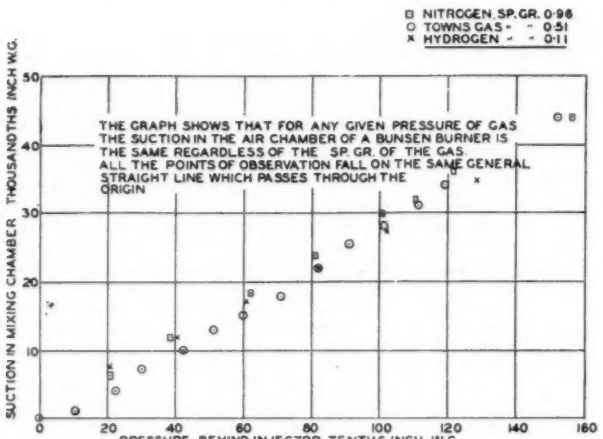

□ NITROGEN, SP.GR. 0·96
○ TOWNS GAS " 0·51
× HYDROGEN " 0·11
THE GRAPH SHOWS THAT FOR ANY GIVEN PRESSURE OF GAS THE SUCTION IN THE AIR CHAMBER OF A BUNSEN BURNER IS THE SAME REGARDLESS OF THE SP. GR. OF THE GAS. ALL THE POINTS OF OBSERVATION FALL ON THE SAME GENERAL STRAIGHT LINE WHICH PASSES THROUGH THE ORIGIN
SUCTION IN MIXING CHAMBER THOUSANDTHS INCH W.G.
PRESSURE BEHIND INJECTOR TENTHS INCH W.G.
0
10
20
30
40
50
0
20
40
60
80
100
120
140
160

FIG. 1.

burner tube in the vicinity of the injector is practically independent of the specific gravity of the gas issuing from the injector providing the gas pressure at the injector remains constant. This is equivalent to saying that the volume of air injected at the point is as nearly as possible the same for gases of widely differing specific gravities, assuming the mechanical features of the injector, &c., and the pressure of gas supply remain unchanged. I mention this particular aspect of Mr. Clark's work because the method of approach in the work of the American Bureau of Standards involved the measurement of burner pressures, although the method was applied in rather a different manner. It must be appreciated that the pressures to be measured are of the order of thousandths of an inch water gauge, and that very sensitive gauges must be used for the work.

The four papers previously referred to were published at different dates, but they may be considered as constituting a continuous study of the physics of the burner. They will therefore be reviewed briefly in the sequence they were published.

Technological Paper No. 193. *Design of Atmospheric Burners.*

The experimental method adopted for determining the air-gas ratio is in broad principle as follows:

Using a sensitive manometer a measurement of the pressure of the air-gas mixture at the burner head was made when the burner was working under normal conditions at known pressure, and supplied with gas of known characteristics. Allowing the gas rate to remain unchanged, air is metered into the air ports under controlled conditions. The rate of air entry at the air ports was adjusted until the pressure at the burner head attained the same value as when the burner was working under the usual conditions. The primary air was metered and the gas was also measured, thus enabling the air-gas ratio to be calculated.

It will be appreciated that for a given burner working at a definite gas rate the higher the burner head pressure the greater is the value of the air-gas ratio.

Starting from theoretical considerations it is claimed that the ratio of the momentum of the gas stream to the momentum of the air-gas mixture for any given burner remains unchanged, irrespective of changes in the injector pressure, gas rate, and specific gravity of the gas supplied. This conception led to the proposal of a mathematical expression which is of great interest, since it enables one to forecast among other things the effect of changes in pressure, volume of gas supplied to injector, and specific gravity, upon the air-gas ratio of the mixture.

It will be agreed that the air-gas ratio is of importance, as it is one of the factors which vitally affects the stability of the flames. An over-aerated mixture may "back-fire," or if the velocity is of a higher order the flames may "blow off" the ports, and inferior combustion result.

The proposed formula is as follows:

$$R = \frac{1658{\cdot}5\ A\ \sqrt{Hd}}{Q\ (r+d)\ (r+1)}$$

Where R = the experimentally determined ratio for any one burner of $\frac{\text{Momentum of gas stream}}{\text{Momentum of air-gas mixture}}$

A = cross sectional area of burner tube in sq. ins.
H = gas pressure at injector in inches water gauge
d = density of gas (air = 1)
Q = gas rate in c.ft. per hour
r = air-gas ratio.

The following experimental results abstracted from the original paper are of interest, since they support the view in regard to the constancy of the value of R notwithstanding changes in injector pressure, gas rate, and specific gravity.

Condition 1.

[Pressure remaining constant, gravity constant, gas rate changing (*i.e.*, size of injector changed.)]

	A.		B.
Gas rate	47·5	..	67·0
Pressure	4·0	..	4·0
Specific gravity	0·65	..	0·65
Air-gas ratio	3·72	..	3·0
Cross-section of burner tube	1·496	..	1·496
Value of R	4·08	..	4·09

Condition 2.

[Specific gravity constant, gas rate constant, pressure changed]

	A.		B
Gas rate	47·5	..	47·5
Pressure	2·0	..	4·0
Specific gravity	0·65	..	0·65
Air-gas ratio	3·0	..	3·72
Cross-section of burner tube	1·496	..	1·496
Value of R	4·08	..	4·08

Condition 3.

[Gas rate and pressure constant, specific gravity changed.]

	A.		B.
Gas rate	45·0	..	45·0
Pressure	4·0	..	4·0
Specific gravity	0·35	..	0·65
Air-gas ratio	4·0	..	4·0
Cross-section of burner tube	1·496	..	1·496
Value of R	3·0	..	3·02

The Design of a Burner.

The Orifice.

The coefficients of discharge for many types of both sharp-edged and channel orifices were determined, and are recorded for reference. In addition, the air-injecting power of the various types was determined. The sharp-edge orifice is shown to have a greater air-entraining power than the channel type when both are passing the same volume of a given gas at the same injector pressure.

Rate of Flow Through Orifice.

The following formulæ are referred to for calculating the discharge from an orifice, and the area of orifice to deliver a given quantity of gas:

$$Q = 1658{\cdot}5KA\sqrt{\frac{H}{d}} \quad \text{or} \quad A = \frac{Q}{1658{\cdot}5K}\sqrt{\frac{d}{H}}$$

Where Q = rate of flow in c.ft. per hour
A = area of orifice in sq.in.
K = discharge coefficient
H = orifice pressure in inches of water
d = specific gravity of gas (air = 1).

Principles Governing Air Injection.[1]

(1) The ratio between momentum of the gas stream and the momentum of the stream of the mixture is always the same for a burner of given design, irrespective of orifice pressure, specific gravity, or the volume of the air-gas mixture going through the burner.
(2) When the gas rate is increased by change of pressure, the momenta of the gas streams are directly proportional to the pressures.
(3) When the same volumes of gas of different gravities issue from different orifices under the same orifice pressure the momenta of the gas streams are proportional to the square roots of the specific gravities of the gases.
(4) When the pressure is changed to give the same gas rate for gases of different specific gravity, the air entrainment is proportional to the specific gravities.
(5) The pressure at any one point in the burner increases in direct proportion to the increase in the momentum of the stream of the mixture.

The Injecting Tube.

There is a definite relationship between the area of the throat of the injecting tube and the port area of the burner that will give a maximum injection of primary air.

It has been shown that the area of the injector throat should be about 43% of the area of the burner ports.

Burner Tube and Burner Ports.

For burners without injector tubes it has been shown how the rate of consumption per sq. in. of port area increases with the increase of port area. A similar series of observations has been made for burners with injector tubes.

The Air Shutter.

The opening in the air shutter must be large enough to allow a free and unrestricted flow of air into the burner.

Before discussing the further work of the Bureau of Standards in this connection it should be noted that other workers in this field have doubted the absolute accuracy of some of the relationships proposed, but nevertheless the general findings are subscribed to.

As already pointed out, provided the value of R for a given burner has been determined the value of *r* can be calculated for changed conditions.

Technological Paper No. 222. Relative Usefulness of Gases of Different Heating Value and Adjustments of Burners for Changes in Heating Value and Specific Gravity.

Valuable as is the data given in Technological Paper No. 193 previously referred to, one is conscious of many unanswered questions. Supposing one can calculate the value for the air-gas ratio under changed conditions of specific gravity consequent upon the distribution of gas of different composition, the following questions are pertinent:

(1) How will the stability of the burner be affected?
(2) What will be the effect upon the efficiency of the appliance?
(3) Can the requirements of modern combustion standards be satisfied under the changed conditions?

These and other such considerations must be dealt with. Technological Paper No. 222 very largely supplies the missing information for burners used in American practice, and although the curves, &c., which supply the information may have to be re-determined for the burners with which we are familiar the paper gives a definite and useful lead. This work carried out in the Laboratory at Baltimore is best understood if subdivided into three sections.

(*a*) Practical efficiency tests were made on two cooker hotplates of differing design and burner characteristics. In all, ten different qualities of gas were used on each of the hotplates. The gas rate and air shutter were adjusted to produce a good flame with each quality of gas in turn. After the completion of each efficiency test the burners were removed from the hotplates, and the composition of the combustible mixture determined by a method similar to that used in the investigation described in Paper No. 193. The conditions in regard to composition of the air-gas mixture and the velocity through the burner ports at which "flash back" to the injector or "blow off" from the ports occurred were determined for each burner, and each quality of gas. The condition leading to yellow tips (*i.e.*, very poor aeration) was also determined.

(*b*) A second series of tests was made in order to establish similar details for each burner when supplied with gases of differing calorific value and specific gravity.

The following gases were used for this purpose:

Water gas of 400, 500, 600 B.Th.U. per c.ft.
Coal gas 525 B.Th.U. per c.ft.

Tests were made at the following B.Th.U. rates: 7,000, 9,000, 11,000 B.Th.U. per hour. The cone and flame heights within which the burner could be satisfactorily operated were observed.

In practice mixtures of coke oven, coal, and water gas sent out in varying proportions lead to changes in specific gravity with resultant differences in air entrainment, and hence the need for section (*b*) of this investigation.

(*c*) A series of tests was made with gases of 500 and 600 B.Th.U. to determine the position of the vessel relative to the burner to give the highest thermal efficiency consistent with good combustion. The tests were carried out at the following rates for each position: 7,000, 9,000, 11,000 B.Th.U. per hour, and the burner was adjusted to give Hard, Medium, and Soft flames.

The character of the work is best understood by reference to one of the many sets of curves given in the paper. The following is quoted as a typical example:

Tests with 500 *B.Th.U. Water Gas.*

BURNER NO. 1.

Analysis of the gas—

CO_2	= 5·1 %	
Illuminants	= 8.5 ,,	
O_2	= 0·3 ,,	
CO	= 32·1 ,,	Specific gravity, 0·641
CH_4	= 11·2 ,,	Non combustibles, 9·3
H_2	= 38·9 ,,	
N_2	= 3·9 ,,	

The results of the stability tests are plotted on the curves below, see fig. 2.

The burner was set for good adjustment at 3 in. pressure water gauge.

The following information may be obtained from the curves on fig. 2:

(1) Curve A shows how the air-gas ratio is affected by changes in injector pressure. It will be observed that the shape of the curve is similar to that obtained by the Gas Investigation Committee.
(2) Curve B shows the B.Th.U. rate for various air-gas ratios at which "back firing" will occur.
(3) Curve C gives similar information in respect of the phenomenon of flames blowing from ports.
(4) Curve D shows the air-gas ratio at various rates at which the aeration will be so poor as to produce yellow tips.

Curves B, C, and D show the limits outside which the burner would not function satisfactorily.

Adjustment of Burners for Gases of Different Heating Value and Specific Gravity.

The different factors which enter into the proper adjustment of a burner are:

(1) Heating value of the gas.
(2) Quantity of heat required.
(3) Composition of the gas.
(4) Pressure.
(5) Specific gravity.
(6) Type of air mixer, air shutter, injecting tube, and size of orifice.

The tests carried out confirm the findings of the Gas Investigation Committee, that within the limits of stability and suitable adjustment of the burner the efficiency of the burner is practically unaffected by changes in calorific value, &c., provided the burner is supplied at the same B.Th.U. rate. It follows, therefore, that the volume of gas that must be supplied for a given purpose depends upon the calorific value of the gas to be used.

In regard to (1), a change in heating value changes the air-gas ratio required for a good flame.

In regard to (3), the kind of gas affects the ease of operation. In general, coal and coke oven gas are less liable to "flash back" than water gas, which means that the range of adjustment for coal and coke oven gas for good performance is greater than with water gas.

The volume of air injected is dependent upon the energy of the gas stream which is affected by—

(*a*) Volume of gas passing.
(*b*) Pressure at injector.
(*c*) Specific gravity of the gas.

[1] Reproduced from Technological Paper No. 193.

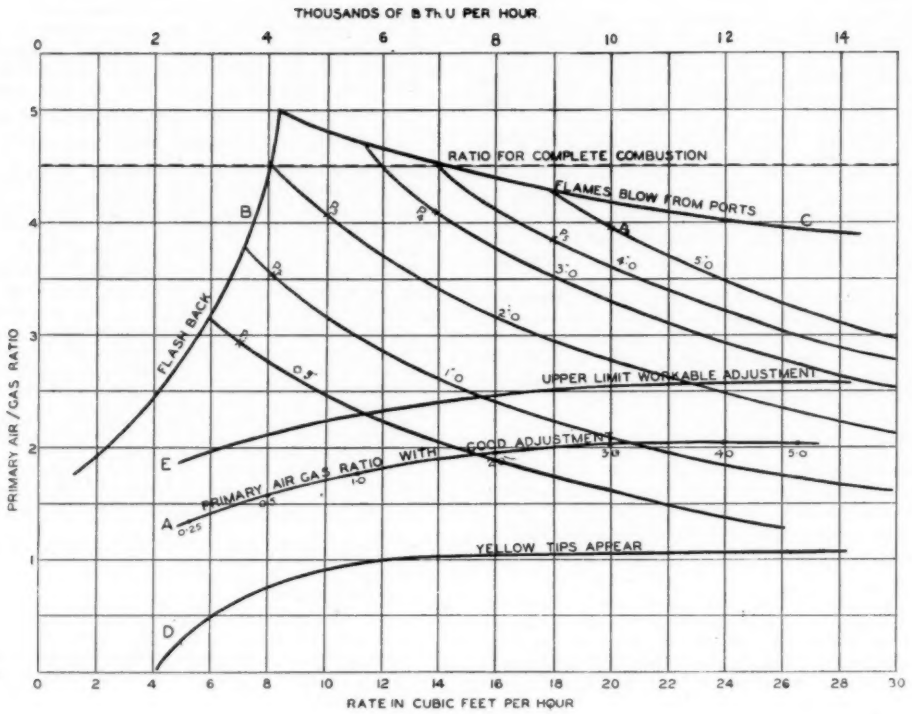

THOUSANDS OF B Th U PER HOUR
RATIO FOR COMPLETE COMBUSTION
FLAMES BLOW FROM PORTS
FLASH BACK
UPPER LIMIT WORKABLE ADJUSTMENT
GOOD ADJUSTMENT
PRIMARY AIR GAS RATIO WITH
YELLOW TIPS APPEAR
PRIMARY AIR / GAS RATIO
RATE IN CUBIC FEET PER HOUR

FIG. 2.

A change in any one of these may necessitate a change in orifice size, or position of air regulator. If to secure good adjustment the air regulator on a burner is almost completely closed it indicates that the burner could be operated equally well using a larger orifice at lower injector pressure.

On fig. 2 curves have also been plotted marked P_1——P_6 showing air-gas ratios obtained with different rates of consumption and at pressures ranging from 0·5 in.-5 in. water gauge with the air shutter wide open. These curves indicate that when the gas pressure is constant and the gas rate is changed by varying the size of the injector, the air-gas ratio decreases as the gas rate increases. It is evident that the minimum pressure required to produce the proper air-gas ratio is the pressure that will give good adjustment at the maximum rate at which the burner is to be operated.

Suppose the burner is to be operated at not more than 10,000 B.Th.U. per hour, reference to curve A indicates that the correct air-gas ratio is 1·95, and reference to curves P_1 to P_6 will indicate that this can be achieved with an injector pressure of 1 in., provided the air adjustment was wide open.

If the curve A was obtained with the air shutter partially open, and one wished to operate on 1 in. pressure, then the injector size must be increased and the air shutter opened to the full open position.

Effect of Change in Heating Value on the Flame Characteristics and Operation of Burners.

In order to study this aspect of the subject a comparison was made of the air-gas ratio and B.Th.U. value per c.ft. of the air-gas mixture when the burner was operated on water gas of 400, 500, and 600 B.Th.U. and coal gas of 525 calorific value. Curves similar to the curve shown in fig. 2 were produced for each of these gases. An additional curve, similar to that marked E and labelled "Upper Workable Limit," was also plotted for each gas.

The data for this curve was obtained when the air shutter was so adjusted that an explosion did not occur when gas was turned off from the full on position of the gas cock except when the gas cock was turned off very suddenly. A burner so adjusted is likely to "fire back" when used for simmering purposes.

The results so obtained are tabulated in Table 1.

A study of these figures indicates that the B.Th.U. value per c.ft. of mixture at the upper working limit is constant around 140-145 B.Th.U. per c.ft. for water gas of values ranging from 400-600 B.Th.U. per c.ft., and that no appreciable difference would be experienced in the use of these three gases with burners adjusted to give a mixture of B.Th.U. value of the order of 140 B.Th.U. per c.ft.

Another very important conclusion is that the range of workable adjustment with coal gas is greater than with

TABLE I.

Heating Value, B.Th.U. per Cubic Foot.	Ratio Air-Gas Required for Complete Combustion.	Gas Rate.	Very Hard Flame. Upper Working Limit. Air-Gas.		Normal Flame. Good Adjustment. Air to Gas.		Very Soft Flame. Yellow Tip Appears at this Condition.	
			Air-Gas Ratio.	B.Th.U. per C.Ft. Mixture.	Air-Gas Ratio.	B.Th.U. per C.Ft. Mixture.	Air-Gas Ratio.	B.Th.U. per C.Ft. Mixture.
RATE, 7,000 B.TH.U. PER HOUR.								
400	3·36	17·5	1·8	143	1·23	180	0·55	258
500	4·49	14·0	2·37	148	1·85	175	0·97	254
600	5·47	11·7	3·13	145	2·46	173	1·30	261
525	4·61	13·3	3·25	124	2·11	169	0·58	333
RATE, 9,000 B.TH.U. PER HOUR.								
400	3·36	22·5	1·87	139	1·28	175	0·58	253
500	4·49	18·0	2·45	145	1·92	171	1·0	250
600	5·47	15·0	3·19	143	2·48	172	1·35	255
525	4·61	17·1	3·33	122	2·14	168	0·69	312
RATE, 11,000 B.TH.U. PER HOUR.								
400	3·36	27·5	1·92	137	1·35	170	0·61	248
500	4·49	22·0	2·50	143	1·95	170	1·0	246
600	5·47	18	3·25	141	2·48	172	1·38	252
525	4·61	20	3·38	120	2·14	168	0·70	310

water gas. With normal adjustment it will be observed that the B.Th.U. per c.ft. of mixture is approximately 170 B.Th.U. per c.ft. for all the gases investigated.

Under conditions when yellow tip occurs it will be noted that the heating value of the coal gas-air mixture is somewhat higher than with the other gases—another indication of the greater flexibility of burners when working on coal gas.

Flame and Cone Heights at Different Burner Adjustments with 400, 500, and 600 B.Th.U. Water Gas.

These dimensions were measured under varying conditions for the three gases and the results plotted on curves. A specimen curve for 500 B.Th.U. water gas referred to in fig. 3 is appended for two B.Th.U. rates.

An examination of these curves, and the similar curves for the other gases will indicate the following:

(1) With the same adjustment gases of the lower calorific values have a smaller cone height indicating greater rapidity of combustion.

(2) For any one gas and adjustment the greater the B.Th.U. rate the greater the cone length.

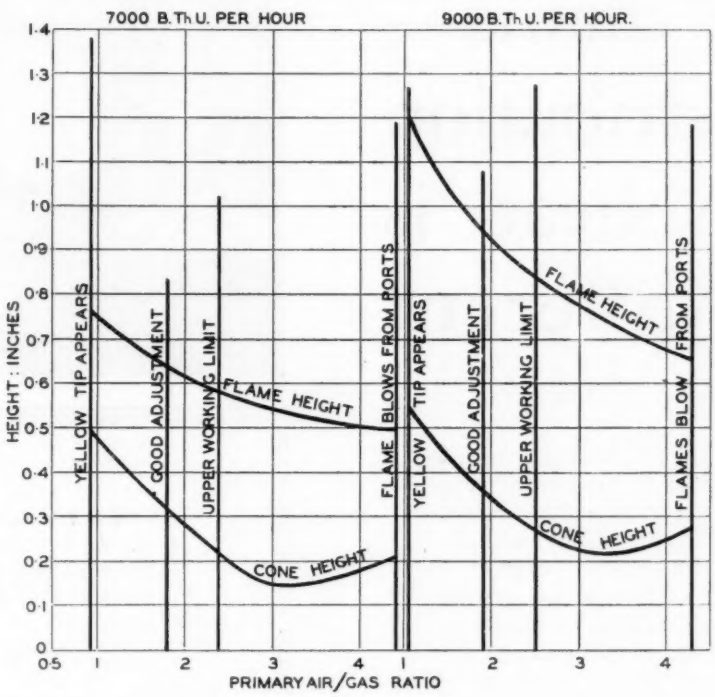


FIG. 3.

(3) Over the range of adjustments at which a burner can be satisfactorily operated the cone height decreases as the air-gas ratio increases until the "backfire" condition is established.

Effect of Changes in Specific Gravity on Performance and Stability of Burner.

This is an aspect of the subject of immense practical importance, and the method of approach adopted in the paper under review will be best understood by reference to the example given in the original. For this purpose the actual curves as published have been reproduced.

Case I.

A burner is designed to work on 500 B.Th.U. coke oven gas of specific gravity 0·40.

Let it be assumed that the burner is required to pass 9,000 B.Th.U. per hour at the given pressure. The previous discussion has shown that the burner will be stable when the calorific value of the air-gas mixture is 175 B.Th.U./c.ft.

The volume of gas per hour will be 18·0 c.ft.

Let x = Volume of air to give correct calorific value of air-gas mixture.
Then volume of air-gas mixture = $(18{\cdot}0 + x)$

$$\therefore \frac{9{,}000}{(18{\cdot}0 + x)} = 175$$

Whence $x = 33{\cdot}4$ and air-gas ratio = 1·85.

Let the burner be regulated at the given pressure to pass 9,000 B.Th.U. per hour and the air regulator set in order that the calorific value of the air-gas mixture may be 175 B.Th.U. per c.ft. Now let the burner without any change of adjustment be operated on gases of varying specific gravity, and the air-gas ratio for each gas be determined by the method described. The results are plotted on Curve C on fig. 4, with similar curves A, B, D, E, for slightly different gas rates and adjustments.

Now suppose it is required to operate the burner as adjusted for the 9,000 B.Th.U. rate, calorific value of mixture 175, on water gas, calorific value 500, specific gravity 0·65.

At the same pressure and injector adjustment the gas rate will be

$$\text{Gas rate} = 18\sqrt{\frac{0{\cdot}40}{0{\cdot}65}} = 14{\cdot}14 \text{ c.ft. per hour.}$$

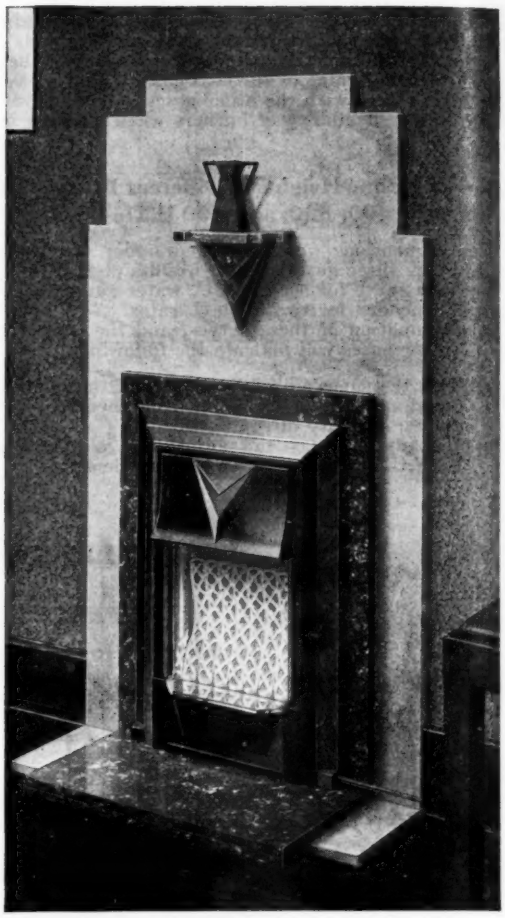
$\therefore$ B.Th.U. rate (500 water gas) = 7,070.

The characteristics of the burner in question when working on the more exacting requirements of water gas have been studied, and the "flash back," "flame blows from ports," and "yellow tip appears" conditions have been determined at the various B.Th.U. rates and the results plotted on Curve 4. The curve for the upper working limit has also been determined.

Reference to Curve C will indicate that the air-gas ratio for this condition is 2·41, and a simple calculation shows the calorific value of the air-gas mixture to be 146·5, a condition corresponding to a very hard flame, and shown in fig. 4 to fall upon the curve for the upper workable limit, an undesirable condition. The second effect of the change is a reduction in B.Th.U. rate and a consequent increase in the time for a given operation.

Commenting upon this result and other similar results, the authors of the report state that "in changing from a coal or coke oven gas to water gas, or from a light gas to

The CRICHTON avoids the monotonous sameness of the ordinary gas-fire flame—its distribution of the heat is also different



The CRICHTON has many differences from the common type of upright gas-fire. Its patent DURAMAIN radiants, for example, are curved, and the angle of impingement of the flame on the various parts results in the top, middle, and bottom of the fire giving various appearances of heat, and a greater radius of warmth upwards, downwards, and horizontally. Thus a 7-radiant CRICHTON can do the work of an ordinary 9-radiant fire.

As can be seen from the illustrations, the CRICHTON has a minimum projection from the grate or panel to which it is fitted.

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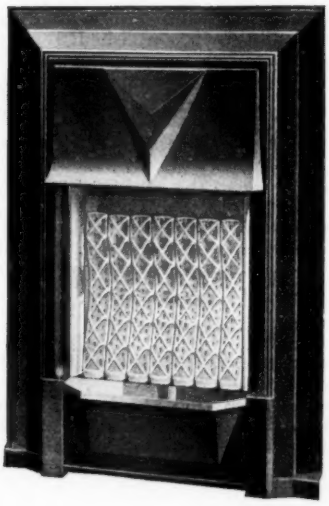

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a heavier gas, less difficulty is experienced if the heavier gas is of higher heating value than the light gas."

Case II.

Suppose the same burner to be operated at the same pressure as in Case I. but now to be working on 500

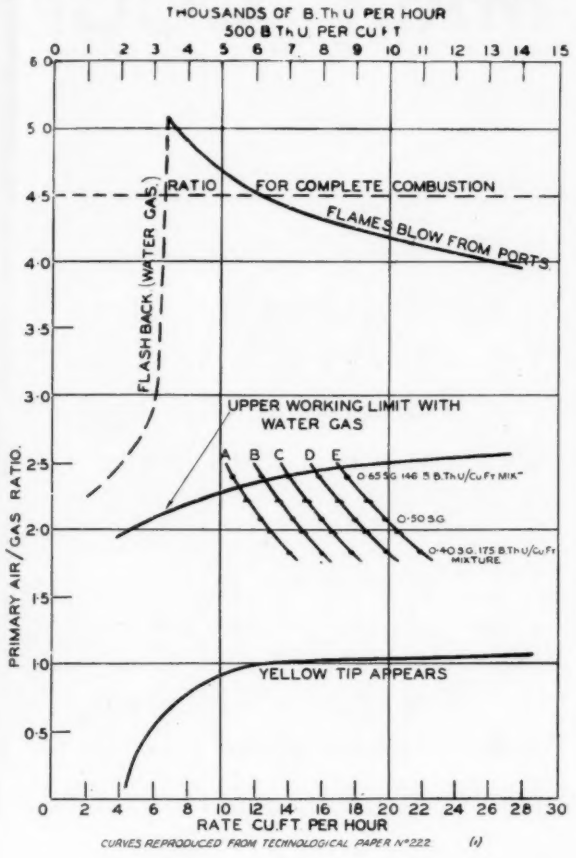
THOUSANDS OF B.Th.U PER HOUR
500 B Th U PER CU F T
PRIMARY AIR/GAS RATIO
RATE CU.FT PER HOUR
FLASH BACK (WATER GAS)
RATIO FOR COMPLETE COMBUSTION
FLAMES BLOW FROM PORTS
UPPER WORKING LIMIT WITH WATER GAS
A B C D E
0·65 S.G. 146·5 B.Th.U/Cu Ft MIX.
0·50 S.G.
0·40 S.G. 175 B.Th.U/Cu Ft MIXTURE
YELLOW TIP APPEARS
CURVES REPRODUCED FROM TECHNOLOGICAL PAPER N°222 (1)

FIG 4.

B.Th.U. water gas, specific gravity 0·65, so as to pass 9,000 B.Th.U. per hour. In order to do this the size of the injector must be enlarged. Let the air regulator be adjusted so that the calorific value of the air-gas mixture is 175 B.Th.U. per c.ft., the condition previously established for stable working, the air-gas ratio will be as before, 1·85. Reference to fig. 5 will show this condition, as is to be anticipated, as well below the upper workable limit.

Now suppose the burner to be operated without change of pressure or adjustment on coke oven gas, calorific value 500, specific gravity 0·40.

The gas rate under these conditions will be increased to 22·96 c.ft. per hour (equivalent to 11,480 B.Th.U. per hour).

Reference to fig. 5, on which has been plotted Curve C for the air-gas ratio for the burner as adjusted in the case under review when working on gases of varying specific gravities, will indicate that the air-gas ratio is now reduced to 1·42. The heating value of the air-gas mixture is therefore 207 B.Th.U. per c.ft. The flame will be softer, and the condition has moved towards the curve labelled "yellow tip appears," but the condition is still well within the workable limits of the burner. The gas rate under these conditions is probably too high for all-round efficiency, but consumers could turn the gas down at the cock; if this is not done waste may occur.

The authors state that "the discussion in this and the preceding section shows that where the heating value of the gas or the specific gravity varies it is necessary to consider the effect of the change on the composition of the mixture and the total B.Th.U. consumption and adjust accordingly."

It is observed that the range over which the changes in specific gravity are considered in this example probably exceeds the range which it would be considered good practice for any undertaking to allow; but it nevertheless indicates that the range over which specific gravities should be allowed to change should be reduced to the absolute minimum consistent with the requirements previously referred to.

The remainder of this paper is concerned with the determination of the correct height of the utensil above the burner in order to promote the highest efficiency consistent with the requirements of good combustion. This condition, of course, has to be satisfied in English practice, but the design of burner head used in this country is rather different from those shown in the paper, which were typical of American practice ten years ago.

Method of Determining the most Favourable Design of Gas Burners.

American Bureau of Standards R.P. 446, 1932.

This paper follows on in logical sequence to the two previous papers referred to in this address. A Bureau of Standards Circular No. 394 was issued prior to the publication of R.P. 446. This circular is summarized, however, in the paper now under review.

Report No. 446 is of special interest because of the experimental method used to measure the air-gas ratio, and from the fact that the Vandaveer apparatus, referred to in the section of this address dealing with combustion, was used for the determination of CO.

The determination of the air-gas ratio was effected by applying the thermal conductivity method to the analysis of the former mixture. The work covered by the paper is apparent from the list of headlines given.

(1) Limits of operation of an appliance.
(2) General procedure in the design of an appliance.
(3) Selection of the burner casting and the number of ports.

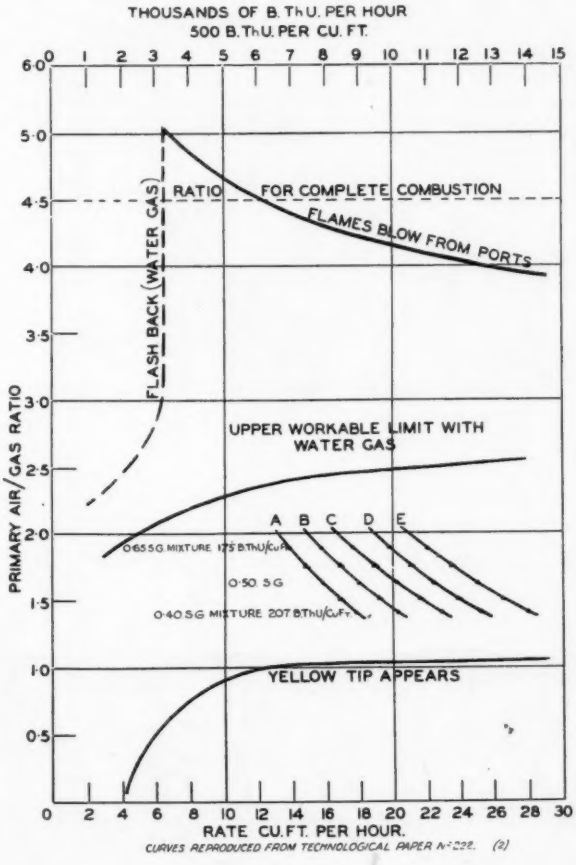
THOUSANDS OF B. Th U. PER HOUR
500 B. Th U. PER CU. FT.
PRIMARY AIR/GAS RATIO
RATE CU.FT. PER HOUR.
FLASH BACK (WATER GAS)
RATIO FOR COMPLETE COMBUSTION
FLAMES BLOW FROM PORTS
UPPER WORKABLE LIMIT WITH WATER GAS
A B C D E
0·65 S.G. MIXTURE 175 B.TH.U/Cu Ft
0·50 S.G.
0·40 S.G. MIXTURE 207 B.TH.U/Cu Ft
YELLOW TIP APPEARS
CURVES REPRODUCED FROM TECHNOLOGICAL PAPER N°222. (2)

FIG. 5.

(4) Determination of flash-back, blow-off, and yellow tip limits, and the effect of varying the port size on these limits.
(5) Determination of the limit of complete combustion and its variation with changes of distance between burner and utensil.
(6) Determination of relative heating efficiency and its variation with changes of gas rate, primary air injection, and distance between burner and utensil.

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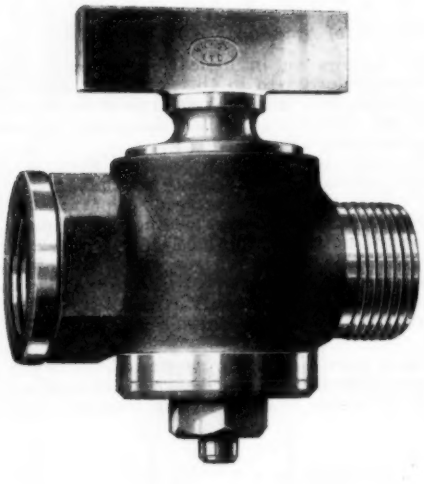

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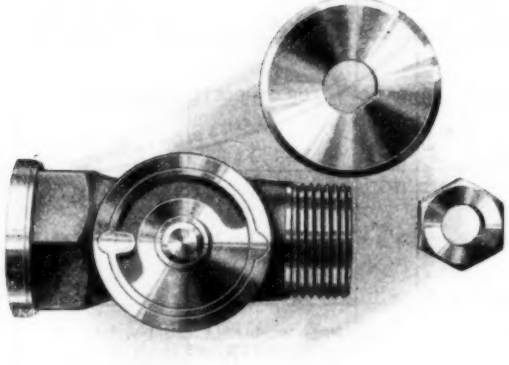

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(7) The time required to perform a given heating operation and its effect on the selection of a proper distance between burner and utensil.
(8) Normal air injection and its variation with orifice size.
(9) Effect of variation in gas pressure and of uncertainties in the adjustment of both gas rate and primary air on the safe range of primary air adjustment. The safe distance between burner and utensil, and the heating efficiency obtainable.

A study of the summary of Report No. 394 is recommended to those called upon to design burners. It provides a systematic method for determining the critical dimensions in burner design.

It may be thought that little further work remains to be done in regard to burner design. This is not our experience, and we have found it necessary to put in hand a fairly extensive programme in this connection. I would advocate, however, a careful study of the work that has been done, as I am sure that if this is applied more extensively much of the "hit and miss" method of design so prevalent in this country can be eliminated. A great deal of work has been done, however, in this country on the design of gas fire burners.

This work has been in the main directed to determine the form of burner casting to ensure equality of pressure under each of the burner teats. A very ingenious method for the measurement of this important pressure is used by Dr. Hartley. In addition considerable work has been done in order to understand the factors which lead to the silent operation of the burner.

The measurement of the sound emitted from a burner is in itself a very complex business, and investigators in this field are keeping in touch with the methods being developed in connection with radio engineering and allied subjects and are applying these methods to the problem. A great deal of work remains to be done in this field, for there are few things more irritating to our customers than noisy burners.

Three papers dealing with the subject of elimination of noise from industrial burners have been published by the American Gas Association and are worthy of careful study, since some of the principles discussed are equally applicable to domestic burners.

Gas Quality.

A great deal has been done in recent years in this connection to improve the service given to the customers. The calorific value is, of course, subject to legal control, and only certain variations are permitted, but in fairness to those in the Industry engaged in the manufacture of gas one must say that the calorific value is kept constant within limits much more narrow than those legally prescribed. This is a remarkable achievement, and we on the supply side have become so used to this condition of affairs that it is taken for granted without recognition of the engineering and technical skill involved to secure this desirable end.

The changes in gas quality which have led to improved service to the customer have in the main been concerned with the minor constituents of the gas. The elimination of the naphthalene trouble has been an inestimable boon to both the Industry and the customer, and there can be little doubt that the reduction in service costs on this account has done much to offset the increased costs at the works. It is difficult to assess the value of improved goodwill between the Industry and its customers on this account, but it is very considerable.

Water Vapour.

The lowering of the dew point of the distributed gas is to be commended for two reasons.

(*a*) Water in service and carcass pipes has practically disappeared on districts where drying is practised.
(*b*) The distribution engineer has been relieved of anxiety in respect to internal corrosion of mains and service pipes, and this is said to give him greater freedom in respect to choice of materials for the distribution system.

It is held by some that the removal of water vapour from the gas has been responsible for the occurrence of the gum trouble, and one is inclined to believe that this is a contributing factor. The cause of gum formation and its prevention is at present imperfectly understood, and it is most unwise to be dogmatic at this stage of our knowledge. I have heard of gum occurring on districts where drying is not practised. I believe that a study of the factors affecting particle size is a matter of some moment.

Sulphur.

Reduction or complete elimination of the sulphur in the gas is an end to be striven for even at considerable cost. The removal of benzole by activated charcoal and other methods has led to very substantial improvement in this connection.

Prior to the introduction of these methods the sulphur content was of the order of 30 grains per 100 c.ft. Now, where these methods are in vogue the sulphur content is often as low as 8-9 grains per 100 c.ft.

This is an improvement greatly to be welcomed. The importance of this matter is recognized in the Industry, and this is evidenced by the inclusion of the subject in the research programme of the Institution of Gas Engineers. It will be remembered that a preliminary report on the matter was issued last year.

It may be helpful to mention one or two reasons why every effort should be made to reduce the sulphur content to the lowest possible figure.

(1) *Toxicological Effect.*—There is cause for no real anxiety on this account as the pungent odour of sulphur dioxide is very apparent long before the dangerous concentration for prolonged exposure of over 0·001% is reached, but a "tang" is probably observed at concentrations as low as 0·0001%. It would be a real gain if the possibility of this "tang" prejudicing the use of appliances otherwise perfect could be eliminated.

(2) *Corrosion of Appliances.*—We are all familiar with the formation of copper sulphate in geysers and like appliances, and would welcome the elimination of sulphur oxides if for no other reason than to avoid this, but the presence of sulphur oxides in the flue gases has a more subtle effect than is generally recognized. Of late years it has been considered good practice to avoid the condensation of water vapour in flueways or in any part of the appliance, as it is known that corrosion is greatly reduced if not entirely eliminated, if condensation does not occur. Whatever method may be adopted to secure this end, it involves the products of combustion not being cooled below the dew point. H. F. Johnstone in a paper entitled. "An Electrical Method for Determination of the Dew Point of Flue Gases,"[1] says the concentration of SO_3 greatly affects the temperature at which liquid will form, and J. E. Maconachie in a paper, "The Deterioration of Domestic Chimneys," published by the Consumers' Gas Company, Toronto, Canada, 1932, referring to H. F. Johnstone's paper, says, "As pointed out by Johnstone a trace of SO_3 in the flue gases was sufficient to raise the dew point very considerably."

The same author, on page 14 of this paper, says, "Condensation would be decreased by any means that would cause the flue gas to have a lower dew point. This might be done in three ways, (*a*) removal of sulphur, (*b*) removal of water vapour, and (*c*) dilution with air."

Some time ago I was concerned with an interesting experiment in this connection. A number of appliances were fitted in duplicate, one set being supplied with town gas of sulphur content of approximately 30-35 grains per 100 c.ft., while the second set consumed gas the sulphur content of which was of the order of 3-4 grains per 100 c.ft. The condensation was collected, and, as was to be anticipated, that from the appliance working on relatively high sulphur gas greatly exceeded that from the appliance operated on low sulphur gas. Moreover, the appliances thus operated were much less affected by corrosion. The papers of Johnstone and Maconachie are both of great interest. The electrical method for determining dew point as proposed by Johnstone has many applications and is well worth referring to by those called upon to make similar observations. Maconachie shows that sulphur oxides in the flue gases have a deleterious effect upon brick chimneys and advocate treatment with chromate and asphalt emulsion.

These and other reasons that could be advanced, should stimulate the endeavour that has already commenced to still further lower the sulphur content of the gas.

(3) *Specific Gravity.*—While realizing the economic advantage of flexibility in manufacturing, the range of variation in specific gravity should be narrowed as far as possible if the best burner performance is to be achieved. Considering the requirements of burners in this respect and the advantage of flexibility in gas manufacture there must be an economic mean position which can be defined and worked to.

Combustion.

There are few matters of greater importance to the proper utilization of gas than that the Industry should thoroughly understand the phenomena of combustion, and it is pleasing to be able to record that few subjects have

[1] University of Illinois Bulletin No. 13, Vol. XXVII., p. 22.

received greater attention from research and technical workers within the Industry during the past few years.

The chemical reactions associated with flames are undoubtedly complex, but they may be approached with understanding by the physical and organic chemist of today. It is not, however, my intention to refer to the more academic work that has been, and is still being, carried out in this field of research. This work is fundamental and of the utmost importance. I wish to refer to the work which is of more direct application to our Industry, and to summarize as briefly as possible the practical effects of this work.

As is well known, the most important product of imperfect combustion is carbon monoxide, and this gas is highly toxic, though less so than such common gases as ammonia, chlorine, sulphuretted hydrogen, or sulphur dioxide.

It is little short of amazing to hear that persons in important public positions still on occasion refer to CO_2 as a poisonous gas, seemingly ignoring that expired air contains something like 5·6% of this gas, and that one of the best-known methods of treating persons suffering from CO poisoning is to administer a mixture of CO_2 and O_2. Since CO is the gas with poisonous effects which may occur in the products of combustion, the research workers have directed their attention in the main to this.

The following figures are quoted by Henderson[1] for the physiological effect of CO:—

Time in Hours × Carbon Monoxide %.	Physiological Effect.
0·03	No perceptible effect
0·06	Just perceptible
0·09	Headache and nausea
0·13	Dangerous to life

These figures are of great interest, as they indicate the order of percentages of CO which have to be determined with accuracy if the results are to be of value in work of this kind. It is not too much to say that such work demands a special technique and a skilled worker.

I have heard of this work being attempted with a gas analysis apparatus of the Bunte burette type; this would be amusing if the results quoted had not been treated seriously. The first step, then, by research workers in this field, as, indeed, is the case in most research work, was to provide themselves with a really precise method of quantitative measurement.

The following are among the methods investigated:

(*a*) The absorption of CO by the blood and the quantitative evaluation by either—
  (1) Colour change (characteristic pink).
  (2) The carmine titration method.
  (3) Spectrum analysis.

  These methods are in the main due to Prof. Haldane, F.R.S., so well known for his work in this connection. The spectrum method is the method still adopted for most physiological work.

(*b*) The reduction of palladium chloride by CO. A reaction of great value in detecting the presence of coal gas. This reaction is the basis of the CO gas leakage detector used by the Gas Light and Coke Company, and has been incorporated in a very neat detection apparatus recently introduced by the Post Office Research Laboratories.

(*c*) The iodine pentoxide method, depending upon the oxidation of CO by oxygen at a temperature of approximately 130° C. and the liberation of I_2 which may be absorbed and estimated.

  This reaction is made use of in certain CO recorders for estimating CO in flue gases. In this case the reaction occurs at normal temperatures, and the liberated CO_2 is estimated.

(*d*) By the oxidation of CO by oxygen in the presence of a catalyst, known under the trade name of Hopcolite. A rise in temperature occurs due to the combustion, which is related to the volume of CO burnt. This rise in temperature can be read with a thermometer as with the Draeger apparatus or can be recorded by means of thermocouples connected to a recording potentiometer calibrated to read directly in CO in parts per 10,000. This instrument is known as the Katz recorder, and has been used extensively by the American Gas Association in connection with their work on combustion standards for gas appliances.

The iodine pentoxide method has been thoroughly investigated for the Joint Research Committee of the Institution of Gas Engineers by—

Wood and Howarth,[1]
Davies and Hartley,[2] and also by
Masterman and Dunning[3] in this country, and by Vandaveer in America, as a result of which investigations it can be said with confidence that the method in skilled hands is reliable.

One would like to pay tribute to Vandaveer for designing an apparatus so much more compact and yet as reliable as the original complicated train of apparatus used in the earlier investigations. I well remember assembling the first apparatus that was used at Watson House for this work, and am therefore in a position to appreciate the advantage and the greater ease of manipulation of the Vandaveer apparatus.

Standards of Performance.

As a further result of these investigations carried out on a very large scale, and involving the examination of the products of combustion from many hundreds of appliances it has been possible to set up standards of requirements for every type of gas consuming appliance in common use. Moreover, the standard has been raised continuously over the years until one may claim the standard of requirement has reached finality and that any apparatus conforming to these standards is beyond reproach in regard to the completion of combustion.

It may be of interest to state the G.L.C.C. standard of requirement in this connection, and to mention that this standard is not an isolated one, but is subscribed to and worked to by all gas appliance makers of repute in this country.

Type of Appliance.	CO/CO_2.	Condition.
Water heaters (Instantaneous and storage types)	0·01	At 100% pressure overload if appliance is not fitted with governor, at 50% pressure overload if governor is fitted (governor out of action)
Wash coppers	0·005	At 100 % pressure overload
Flueless radiators	0·001	" " "
Gas fires	0·005	" " "
Boiling rings	0·005	" " "
Grillers	0·005	" " "

When governors are fitted the apparatus is considered satisfactory if these CO/CO_2 ratios are not exceeded at 50% pressure overload.

It should be understood that the ratios are in practice much lower than those shown in the table when the apparatus is working at the consumption for which it is designed. It is becoming standard practice with all new apparatus fitted by the Gas Light and Coke Company to arrange for a pressure point near the point of combustion. The fitter is provided with details of the pressure and gas rate at which the appliance should operate, and it is his duty to adjust the apparatus to the correct working pressure and gas rate. I would advocate a more extended use of that simple, but invaluable, little apparatus, the U gauge.

Combustion and the Design of Appliances.

An equally important result of these investigations has been to establish a clear understanding of the factors which if ignored may lead to inferior combustion.

These have been well dealt with by E. W. B. Dunning in a paper given in 1931 before this Association, and have been amplified in a Report on Combustion Standards of Gas Appliances presented to the Institution of Gas Engineers by C. A. Masterman and E. W. B. Dunning in 1931. The work of the American Bureau of Standards is of great interest in this connection, and the contribution entitled "A Method of Determining the Most Favourable Design of Gas Burners," reported on pages 669-709, Bureau of Standards Journal of Research, Vol. VIII., 1932, may be regarded as typical.

The work done by the A.G.A. is well known, and it should be mentioned that the Gas Industries of many Continental countries have definite standards of performance for combustion, and have added their quota to the fund of knowledge on gaseous combustion. This salient fact that emerges is that the causes of inferior combustion are well understood, and the designer of modern gas appliances has no excuse for putting upon the market apparatus

[1] Henderson. *Journal of Industrial Hygiene.* Vol. 3, p. 79, 1921 "Physiological Effects of Automobile Exhaust Gas."

[1] Trans. Institution of Gas Engineers, 1925-1926, pp. 105-154, also 1926-1927, pp. 130-142.

[2] J.S.C.I. Trans., Vol. 45, p. 164, 1926.

[3] Institution of Gas Engineers, Communication 41, 1931.

which does not comply with these standards, and the Gas Industry still less excuse if they were to purchase and fit such apparatus.

It is fair to say that some of the leading makers of appliances have been foremost in their efforts to bring about this happy state of affairs.

To summarize, the workers in this field have provided the Industry with:

(*a*) Accurate methods of determining CO in percentages far below those having a physiological significance.

(*b*) Have laid down standards of combustion of the highest requirement. These standards which can be, and are, attained in practice enable conforming appliances to satisfy the most exacting physiological requirements in regard to combustion.

(*c*) Have clearly defined the important factors to be observed in order to attain these results, thus rendering great service to those called upon to design appliances.

Appliances in Relation to Environment.

No sane person would suggest that even appliances conforming to these high combustion requirements, whether fitted with flue equipment or otherwise, can with safety be fitted in an environment in which no air change occurs, any more than they would suggest that locking the hundred or so persons into the "Black Hole" of Calcutta was a proceeding beneficial to the health of the occupants of that famous prison. In a later part of this address the conditions necessary to promote comfort are discussed, and it will be apparent how necessary is adequate ventilation.

It is somewhat surprising to see in view of the investigations referred to later how many architects are erecting buildings without providing for the elementary requirement of effective ventilation.

It would be unnecessary to state—if our competitors did not so persistently ignore the fact—that, whatever be the source of heat in an apartment, adequate ventilation is necessary if healthy conditions are to be provided. In any room in which the ventilation is unduly restricted if a source of heat be present, the air temperature will rise, and the amount of heat lost by the human body by evaporation will be excessive. In consequence, uncomfortable conditions will arise.

It is a commonplace to state that no matter how perfect the appliance, as such, may be, and no matter what the source of heat, it is essential to consider the appliance in relation to the environment in which it is to be used if the result is to be satisfactory.

In the case of gas if the appliance is to be used without a flue it must be frankly admitted that there is one factor which electricity has not to contend with—viz., the products of combustion.

(*To be continued.*)

Australia and the Rotherham Tariff*

By A. J. Dobson, of Adelaide.

Neither the Rotherham tariff nor any other provides a simple and easy or assured price policy for world-wide application. Local conditions must always govern the introduction and success of any method of charging for gas service.

But Rotherham had difficulties to surmount just as great as, if not greater than, most Australian companies have, and if the policy is good it can generally be introduced. The bogey of restrictions mostly disappears when thought is earnestly concentrated on overcoming restrictive obstacles. Australian conditions surrounding, and in, the Gas Industry are not uniform, and therefore there cannot be a single charging method of nation-wide application. Nor do I think a uniform method is desirable. It suppresses enterprise.

The most obvious feature in the tariff is its dependence for success on selling "extra gas" to the consumer.

The lowest service charge of 9d. would have bought 900 c.ft. of gas per month on the old basis. The new rating only confers a benefit after 1,200 c.ft. The highest service charge (2s. per week) would have bought 2,400 c.ft. of gas per month. The new rating only confers a benefit after 3,200 c.ft.

The writer contends that the sound policy of gas supply should be to give the consumer more and better gas service without necessarily gaining extra profit for the Company. It is the "service" of gas that will ensure its permanence.

Extra gas can generally be supplied at a cost astonishingly low compared with the average cost of present output. If gas can displace coal at Rotherham it should be able to displace every alternative fuel in Australia.

A careful and scientific locality study of costs of present and expanded output should be the precursor of any tariff construction.

A careful and scientific locality study of individual consumptions should be the precursor of any tariff ratings.

A careful and scientific locality study of present methods of heating, potential heat requirements, and the general attitude of the public should be the precursor to any tariff policy.

The writer's answer to the question "would a tariff similar to that adopted by the Rotherham Corporation Gas Department lend itself to Australian Conditions"? is definitely in the affirmative. The tariff has peculiarities to suit local conditions which would obviously be unsuited to the conditions of any Australian gas undertaking and modifications would consequently have to be made. Rotherham, however, is pioneering the way by striving to give "greater gas service," in the belief that "gas service" can supply the home with greater comfort, quicker and better heating, and at a cheaper cost than any comparable rival fuel.

The Rotherham tariff does lend itself to Australian conditions as a model or type of a promotional tariff which in its experimental trials achieved extraordinary success. Whether it will be preferred (being optional) by the bulk of Rotherham consumers remains to be seen.

The "sales field" to which it was applied seems to have had the same characteristics as those that surround almost all Australian gas undertakings—*i.e.*, the capacity to supply is much greater than the demand for the commodity.

The tariff certainly cannot be applied without modification to local needs, but in its fundamentals it has been shaped to overcome problems that are almost universal in the gas supply world.

The guiding principles in its formation appear to have been:

(1) The extra business must be possible and visualized.

(2) The consumer's needs have to be appreciated.

(3) The cheapest gas (in Great Britain) can be made cheaper still.

(4) The selling power of the small denominator is a powerful ally; hence the service charge at per week instead of per month. Also a small price (10d.) to contrast with a large quantity (1,000 c.ft.).

(5) The most inexpensive rival fuel can be attacked and displaced.

(6) The consumer can be shown a saving on his heating costs.

(7) The extra gas will provide a profit at a relatively very low selling price.

(8) The service of gas is still capable of wonderful expansion.

Rotherham has provided an example and inspiration—without effort nothing is achieved; with optimism and the will to do everything is possible.

Lead on Rotherham—Advance Australia!

* From a paper before the Australian Gas Institute.

Yorkshire Junior Gas Association

Annual Meeting and Address by Mr. Ralph Halkett

The 31st Annual General Meeting of the Yorkshire Junior Gas Association took place at Leeds University on Oct. 20, with Mr. B. THORPE (Huddersfield), the retiring President, in the chair.

Mr. THORPE extended congratulations and good wishes to members who had successfully passed the various examinations of the Institution of Gas Engineers and the City and Guilds of London Institute. In this connection, it was interesting to note that of the total of 446 examination successes for the country, 48 were men of the Yorkshire area. A point still more worth noting, however, was that of these 48 only 18 were members of the Yorkshire Junior Gas Association—a factor which indicated that there was still in Yorkshire, despite the excellent strength of the Association, a potential further membership. Yorkshire had 11% of the total examination successes, and, comparing that figure with London's approximate 22%, he did not think the comparison was at all unfavourable when one recollected the much better facilities available for students in the London area. Mr. Thorpe said he regretted he had no figures available as to City and Guilds results, but he wished particularly to congratulate Mr. T. Smith, of Leeds, Institution Bonze Medallist last year and Silver Medallist this year.

The Annual Report.

The Annual Report, presented by Mr. J. R. FIRTH (Bradford), the Hon. Secretary, stated that ten meetings had been held during the session, including the customary joint meeting with the Manchester District Junior Gas Association. The membership of the Yorkshire Association was now 206, a net increase of six on the year. Congratulations were extended to the various members who had received promotion during the year, and particular mention was made of Mr. D. T. Livesey, appointed from Deputy-Engineer to Engineer and General Manager at Doncaster; Mr. G. E. Currier, from Deputy-Engineer to Engineer and General Manager at Bradford; and Mr. J. E. Wakeford, appointed from Chief Assistant at Elland to be Deputy Gas Engineer at Plymouth. The Association had continued, through its appointed representatives, to take an active part in the work of the Yorkshire District Education Committee—a committee which could be of great assistance to students seeking advice in the arrangements of their studies; and members of the Association were strongly recommended to avail themselves of the facilities offered.

The Financial Statement, submitted by Mr. T. G. LEWIS (Leeds), the Hon. Treasurer, showed receipts for the year of £171, and a credit balance of £80, as against £86 last year.

The Report and Financial Statement were accepted, on the motion of Mr. A. E. DICKSON (Sheffield), seconded by Mr. H. RAISTRICK (Bradford).

The New Officers.

The following officers were elected for the coming year:

President.—R. Halkett, Junr. (Sheffield).
Senior Vice-President.—J. W. Carlton (Shipley).
Junior Vice-President.—E. R. B. French (Leeds).
Treasurer.—T. G. Lewis (Leeds).
Hon. Secretary.—J. R. Firth (Bradford).
Assistant Hon. Secretary.—R. H. McCulloch (Sheffield).
Hon. Auditors.—A. W. Arnold (Bradford) and F. Lodge (Wakefield).
Council.—A. Wylie (Sheffield), R. N. Webb (Leeds), W. H. Blundstone (Dewsbury) for three years, and Messrs. J. K. Mitchell (Brighouse) and E. Bailey (Cleckheaton) for one year.

Messrs. J. W. Horwill (Bradford), B. Thorpe (Huddersfield), R. N. Webb (Leeds), and A. Wylie (Sheffield) were re-elected the Association's representatives on the District Education Committee, on which Mr. S. H. Packer (Bradford) has also been a co-opted member since the inception of the Committee.

The New President.

Introducing the new President, Mr. THORPE said Mr. Halkett, Junr., was one who really needed no introduction to the members of an Association to which he had given excellent service. Mr. Halkett was the worthy son of a worthy father who was himself a former member of the Yorkshire Junior Association and who had never ceased his warm interest in and friendship for the Association since becoming one of the most highly esteemed Seniors in the Industry. Mr. Ralph Halkett, Senior, was still an Hon. Member of the Association of which his son was about to become the President.

Mr. R. HALKETT, Junr., accepting office, presented the Association's Past-President Medallion to Mr. Thorpe. He thanked the members for the high honour they had done him, and said that the Association were parting with a President, in Mr. Thorpe, who had filled the office with particular ability.

Mr. THORPE, expressing thanks for the medallion, said the year had been marked by many happy times and by the making of an ever-growing number of friends in the Industry. He wished to pay tribute to the support he had had from his fellow members of the Council and other officials, and particularly to the splendid help he received from their Hon. Secretary.

A vote of thanks to retiring officers, members of Council, and representatives on the Education Committee was accorded on the proposition of Mr. S. T. S. MUSGROVE (Sheffield)—who also paid tribute to the work of the Secretary—seconded by Mr. G. W. KAY (Selby).

Mr. THORPE briefly responded, and in doing so made reference to the excellent work of the members of the Education Committee, whose Chairman (Mr. Bridge) they were glad to have as one of the Association's warmest friends and a very frequent visitor to their meetings.

Mr. J. BRIDGE (Engineer and Manager of the Elland-cum-Greetland Gas Company), responding to the expression of thanks on behalf of the Education Committee, said the Association gave most valuable service to that Committee not only by its appointment of highly capable representatives but by providing the Committee with a most capable Hon. Secretary in Mr. J. W. Horwill, of Bradford. Meetings of the Committee during the past year had not been so frequent as on some occasions and this was due in large measure, Mr. Bridge believed, to the ability of Mr. Horwill, as Secretary, to advise students without requiring to call the members of the Committee together. It was interesting to note that of the 49 certificates which were to be presented at the next meeting of the Manchester District Association of Gas Engineers, no less than 23 would be to Yorkshire students. Of the 10 certificates in the Higher Grade Gas Supply, all the ten would be coming to Yorkshire, and it was a tribute to the teaching ability of Mr. Thorpe, the Yorkshire Association's retiring President, to notice that of those ten, six were students of Mr. Thorpe's class at Huddersfield.

ADDRESS

of RALPH HALKETT, M.Inst.Gas E., General Manager and Secretary of the Sheffield Gas Company.

It gives me great pleasure to be with you to-day at the opening of your session, particularly because you have honoured my son by appointing him your President for the ensuing year.

Eight years ago I had the privilege of addressing your Association upon the occasion of Mr. Musgrove becoming your President, when I stressed the importance which the Industry you serve plays in the life of the whole community, and how it calls for the utmost efficiency among the men who serve in it. That statement, so true then, is even more so to-day.

In eight years our Industry has seen great changes. Its outlook has become wider, and its usefulness has penetrated farther than ever into the spheres of home life, business life, and factory life. Competition from other methods of lighting, heating, and power has intensified, and we welcome this competition, because it acts as a stimulant to us all to strive for better and better results.

We do grumble occasionally at the unfair assistance that is given to one competitor over others, but we realize that this unfairness comes not from within that industry, but chiefly from outside sources. So far, the Gas Industry has been ruled by motives of fairness, honesty, and loyalty to an industry to which we are proud to belong and to serve—an industry which throughout its history can boast of clean and honourable dealings, both with the general public whom it serves, and with its supporters, whether ratepayers or shareholders. It shows a clean financial record, and its integrity is unimpeachable.

We are none the less a very much maligned Industry.

We have restrictions imposed upon us on every side, and we are now often told that gas is a "back number."

Lighting.

In this pleasure seeking and luxury loving age, the desire for everything that can make life easy is pushing other considerations into the background, and this is the only country in the whole of Europe—I think I might say in the known world—where this desire is being indulged in to so great an extent at the present time. Because our chief competitor—electricity—can switch the light on with a button, and is therefore easy, we are being taught that it is the only possible lighting agent to use in modern times, for rich and poor.

Now, my own house is lighted throughout with gas, worked by switches, and I maintain that it is as efficient and artistic as any lighting agent in existence for general purposes, while in addition, I gain by its use a means of ventilation, a slight warming agency, and the knowledge that the light is non-injurious to the eyes, economical, and reliable. It never fails.

Fortified by the knowledge that we have a thoroughly good and competent lighting agent to sell, we should urge over and over again that more homes and more public institutions and factories should be lighted with gas. Only recently, large parts of the country have been plunged into darkness, and great inconvenience must have been caused—perhaps lives lost or endangered, if not directly, then indirectly—through the breakdowns of the electricity grid. One hears daily of lives lost in collisions with motorists, trains, aeroplanes, and in the mines and factories, but how very little one heard, in detail, of what actually happened through the breakdowns of the electricity grid. A short paragraph in the papers, and it was finished with.

There are instances in which electric light can be used with advantage over gas lighting, but it should be openly recognized that gas is, in most instances where health, reliability, and economy are concerned, the best and always the most efficient.

Does the ordinary man in the street know that a gas mantle gives the same efficiency until it breaks, whereas an electric bulb is losing its efficiency day by day, although it still consumes the same amount of current, for which he pays? I feel strongly on this question of lighting, for I do feel that it is unfair to the man of small means to have it forced upon him that electric light is the best for his home, when it is not so by any means from the point of efficiency, cheapness, and health.

I also feel that we in the Gas Industry are becoming apathetic on the point. It is true that we have forged ahead on so many other points that the lighting load appears less important, but we should not slack up on any one point that concerns the usefulness of gas. Because people in large, lofty, and well-ventilated rooms can use electricity with impunity, it is not fair to let the owners of smaller rooms—who have to live in more or less crowded conditions—think that it is equally good for them.

We are building new houses, and giving so far as possible modern amenities, with which I am in full agreement and sympathy; but the rooms of these houses are still small, and the families are still large, so that the numbers that gather together in small spaces need all the means of ventilation that is possible, and where money is scarce the additional warmth given out by gas lighting can be very acceptable.

I do not grudge the poor man all the comfort he can get, if it is commensurate with health conditions and his means to pay without suffering, and his wife needs all the labour saving devices that it is possible to put within her reach; but this cannot apply to the competition between gas and electric lighting. They are equally easy to manipulate, whether by switch, by-pass, or match.

Therefore, I maintain that gas is a most important and efficient lighting agent, and it behoves us to keep it before the public eye with confidence, and with the assurance that we are offering a perfectly good article, and we should urge upon the manufacturers of globes, &c., to maintain cheap and artistic designs to offer in our showrooms.

An Electrical Installation Displaced.

To substantiate my remarks on the suitability of gas for lighting, I would like to give you an example from Sheffield. A few years ago a certain firm employing a large number of workpeople went over to electric lighting for the benches in the workshops. This was so unsatisfactory that after certain representations were made by the Gas Company, we were allowed to supply and fit on approval a specimen gas lamp, of modern design. As a result of the satisfaction obtained therefrom, the entire electrical installation was displaced, and the bench workshops relighted by means of gas.

It is interesting to note that during the present week I have been told by an outside source, to whom the information was given by the firm quite voluntarily, that since the reversion to gas in these particular works, the cost of lighting for bench work has been reduced by 50%.

With such a testimonial as this, don't you think we have a right to go forward for this class of work with every confidence, knowing that we can give such results? There is no reason whatever why lighting of this description should pass into any other hands than those of the Gas Undertakings.

I may mention that in Sheffield we are doing our utmost to retain gas for domestic lighting, and in support of this statement I might tell you that since the year 1923 upwards of 55,000 installations, including lighting points, have been fixed in the working-class houses of the Sheffield district alone. This arrangement also permitted my Company to carry out new installation work with piping of an adequate size, and presented a unique opportunity to replace obsolete installations, which were often found in a dangerous condition.

The public are being trained to become electrically minded. They would not become so of their own accord, and therefore we must combat this with all the energy and resourcefulness at our command.

In cooking and heating we are holding our own all over the country, as the results and statistics that are published clearly denote, but we must not, on that account, slacken in our efforts. There are still in my opinion many developments to be made even in those branches, and we need men of science and research to use all their efforts to discover these.

The Industrial Field.

Then there is the industrial field in which gas has undoubtedly an overwhelming future, not only in the large industrial cities, but in the provincial towns and small places where gas can be introduced for use in almost every trade. In this department, the public have to be educated as to the application and uses of gas. They have to be convinced that it will do the work more economically than, and as efficiently as, any other method, and when once this is proved to them, they are ready and quick to adopt it.

As you are aware, my Company has a very large industrial load, and in recent years the increase has been considerable, but I am fully convinced that had we not laid ourselves out to develop that branch, the results would not have been anything like they are to-day. We introduced a special Research Laboratory and installed fully qualified men to devote the whole of their skill and knowledge to meeting the demands made upon gas for use in the factories and works of the district.

This brings me to a subject I have very near at heart, and in which I know many of you and many of the Senior Associations are deeply interested. We do need to specialize in training.

The old days are gone when a gas manager could depend upon his knowledge of engineering to carry him through. He has to be a "Jack of all Trades" in these modern times, and his knowledge must be all-embracing and far-reaching. There can be only one captain to a ship, and he must be able to control and guide all that is necessary for the good and welfare of that ship. This covers a large field, and may appear alarming, but it is not an impossibility. I may be taken to task when I say that in my opinion a practical training is absolutely necessary for anyone who is to become a chief of a gas undertaking. In order to compete nowadays, the price of gas *must* be cheap and within the means of the poorest individual. We cannot sell cheap gas without knowing personally where to look for details that may add to, or deduct from, working expenses. Our employees also have a greater satisfaction in carrying out their duties when they know that the man who makes the demand knows his job.

It goes without saying that a sound Public School or Secondary School Education is necessary in the first place, and a special point should be made of proficiency in mathematics and English.

This I would suggest should be followed by a training of not less than five years, which should be spent in the following way. A period on the gas-works, commencing with the fitting shop, followed by another period in the laboratory. There should be time spent in actually working on all plant in connection with the manufacture and purification of gas, in the drawing office, in the gas mains department, the gas fittings and sales department, and in the rental and accountancy department.

University Men.

A prominent question among us just now is the absorption of University trained men into the gas engineering profession. I consider this a very essential point. These men can become specialists in a way that it is impossible for

the head of a large undertaking to become, and we need specialists to undertake research in the various departments if we are to keep abreast of the times to-day.

What I should like to see in our Universities are opportunities given to the men who are taking the practical work of perhaps two afternoon courses per week.

The system at present in existence—of attending a University for two or three years—providing students are given facilities for taking up practical work during the vacations—is not taken seriously enough in regard to the practical side. They look upon the University training as the main branch, and their qualifications and degrees are based chiefly upon that.

If such a scheme as I suggest could be put into operation, then I would like a portion of the examination to be based on the practical side, thus making the examination more valuable professionally. Once the training is over, there is still a period to be allowed for gaining experience before a post carrying a fair salary can be sought, and I would suggest that short periods should be spent in the different departments, gaining experience that would be invaluable in the future, and that would enable anyone to seek and fill a position of responsibility with proper remuneration.

The commercial side must by no means be lost sight of, for it is of the utmost importance, and it is impossible to obtain experience except through the actual working channels. Some years back, business came without seeking, but to-day the whole system is revolutionized, and we need to be alert and full of energy and alive to all the possibilities that lie before us. The maxim must be, "Business first, and pleasure afterwards," for all our skill, energy, and ability must be concentrated upon selling cheaply the commodity and appliances we are dealing with.

No detail is too small for the official to give his whole attention to, whether he be only a junior or the one at the top of the tree. The Scotch saying "Mickles mak Muckles" is very applicable to all the branches of our great and flourishing business, and the more we can concentrate on giving gas at a low price, while preserving its efficiency and quality, the more will the Gas Industry flourish. There are many places in the country where the price of gas is much too high to compete successfully with electricity as it is being sold, and will be sold in the future, from the grid, and every energy should be strained to reduce the price of gas to meet this competition.

Amalgamation and Absorption.

The general trend of affairs at present is for amalgamation and absorption of the smaller gas undertakings throughout the country by their large neighbours. It may be that eventually many small districts may form themselves into combines or grids. I do not say this as an expression of my wishes or desires, but because it is what I think will be necessary in order to compete with the electrical grid scheme; otherwise many of the small undertakings will be wiped out of existence completely, as they could not possibly compete in price or economical working, nor perhaps in efficiency, due to lack of capital.

We cannot expect the keen and competent young man of the rising generation, lacking the chances of a university training, to be contented with such a prospect. He should have more scope for his abilities as a departmental manager working in connection with a large undertaking.

The type of training he would be able to get would be very suitable for jobs of that description, which would be as remunerative as, if not more so than they are to-day as, separate undertakings.

It is because I realize that it is not possible for everyone to obtain university training through geographical or financial circumstances that I would not have those members of our profession become discouraged. Real zeal and ability will tell in the long run, so that the exception to the rule may be recognized, and genius force itself to the top of the tree, although the person may not be trained upon orthodox lines.

It is only natural to assume that all members of our Junior Associations are desirous of attaining the highest administrative positions possible, and as I have stated on previous occasions, it is necessary and essential that you should have the practical experience as well as the technical abilities for such a post. It should not, however, be forgotten that a knowledge, however slight, of the method or methods of manufacturing and distribution costs is a principal factor in enabling you to carry out the duties of an administrator to a successful issue.

Costing.

I consider it very necessary that all undertakings, irrespective of their size, should have a regular method of arriving at their costs, and this should not be difficult, for there is a regular method laid down for our guidance. It has been said that costing is not an exact science any more than accounting, but its object is to obtain as accurately as can be expected the costs of the various processes of manufacture and services which a gas company undertake.

In my own experience in the Industry, watching the costs has ever been one of my chief points, and especially in these days of strenuous opposition and competition, it should always be our duty to keep a firm hold on the manufacturing and distribution charges.

No matter whether we are a corporation or a company undertaking, it is up to us all to see that there is no leakage or waste in our methods of working, for, after all, it should never be forgotten that the greatness of our success can only be built up by the cheapness of our price and the size of our profit.

I should like to give you a brief outline of the methods I have instituted for the purpose of watching my costs barometer. It is usual I know in some undertakings to have a special staff for the purpose of collecting and analyzing the wages and accounts of the manufacturing, distribution, and management charges. I have, from experience, built up a system of costing which is capable of expansion, and which enables me, within 24 hours after the wages are made up, to see where any extraordinary expenditure in wages has taken place in any section of the works.

The works wages sheets are made up of 12 sections, these sections being sub-divided to include all classes of work. In addition to these sections, the analyses show the coal carbonized per retort, the gas made per ton of coal carbonized, the total cost of wages per ton of coal carbonized, and the cost of wages per 1,000 c.ft. of gas made. In the distribution department, the same method applies, so that the weekly wage charges of the various sections may be seen at a glance.

In dealing with the accounts for materials, these are allocated by number and posted to their respective section books for the purpose of making a monthly cost of gas into the holder, this taking the usual lines of the revenue account.

In addition to the making of weekly working costs, I have drawn out monthly what I may call my revenue statement. This statement is partly estimated and partly actual, and shows my total income and expenditure for the month. This monthly statement I have always found useful, and it enables me to gauge how the undertaking as a whole is getting along in comparison with the corresponding period in the previous year.

Time will not permit me to enlarge or go into details, but I think I have mentioned sufficient on costing to show you that this work is necessary in the carrying out of our duties in a proper manner. I might add that there need be no extra expense involved in this work, as all allocation numbers, whether for manufacturing or distribution charges carried on the wages or accounts, are made to fit with the accountant's requirements, and are ready for him to post to his journal. This method has also the advantage of making a double check on the allocation of all charges.

Vote of Thanks.

Mr. J. W. Horwill (Bradford), moving a vote of thanks to Mr. Halkett, said the matters raised in Mr. Halkett's address that day were of supreme interest and importance. As one who, like Mr. Halkett, had modern gas lighting in his own home and was proud of it, Mr. Horwill felt the members of the Industry ought to pay much more attention to the task of retaining the lighting load than, he feared, was being done in a good many cases. It could not be too strongly stressed both in the public and the Technical Press that gas was by no means a back-number for lighting and would not be for many years to come. The references to the educational side of the Gas Industry, Mr. Horwill felt, were factors with which everybody present heartily agree, and were of particular importance to the younger members if they had any ambitions to make progress in the Industry.

Mr. J. Richmond (York) seconded the vote of thanks.

Mr. Halkett, responding, said that day he felt himself a very proud father. He often looked back on the happy times he had had as a member of the Yorkshire Junior Gas Association and he could not deny he felt a good deal of pride in the fact that his own son had come to be honoured by the Presidency. In his own day as a general member of the Association he had made a point of attending the meetings as regularly as possible, because he realized—as he hoped all young men to-day would realize—that the proceedings at those meetings were calculated to be of very real help in one's personal progress as well as helping in the maintenance of a very important Industry. Those were days when members had to pay all their own expenses to

get to the meetings, but the expenditure of time and cash was well worth while. To-day many members were more fortunate in that respect, and he hoped they were taking full advantage of the facilities so kindly afforded them by their undertakings. In regard to the subjects of his address, he agreed with Mr. Horwill that the lighting load was one to which members of the Industry ought to pay very special attention. They never ought to play "second fiddle" to anybody in regard to lighting, as they had been rather too much inclined to do of late. He was not saying their rival had no just claims, but for street lighting, factory, and workshop lighting, and particularly for the homes of the working man, he suggested there was no better lighting service than the modern gas lighting, alike as to cheapness, efficiency, and health, and they should go all out to fight for the retention of gas. At Sheffield, as in some other places, they were having to fight to retain gas for street lighting, because of the popular fancy for the newer lighting agent. Particularly was this difficult where the gas service was by a company and the electric by the municipality. It was not unnatural that the municipality in charge of streets should have a mind favourably inclined towards using its own lighting product, and it was only by persistent proof of the thorough efficiency and cheapness of gas that they could retain a load under circumstances of that kind.

Thanks to the authorities of Leeds University for the use of the meeting room and hospitality and co-operation on many occasions, were voiced on behalf of the meeting by Mr. E. R. B. FRENCH (Leeds) and seconded by Mr. J. N. DOUGHTY (Sheffield).

Mr. H. J. HODSMAN, M.B.E., M.Sc., F.I.C., of the University staff and a member of the Association, responding in the unavoidable absence of Prof. Cobb, said the University authorities were always glad to be of any help within their power. As a member of an educational institution, Mr. Hodsman had been especially interested in Mr. Halkett's observations on the subject of training. He agreed very much with what Mr. Halkett had said. The University attempted to make its teaching programme coincide as far as possible with the practical side of the Gas Industry. After all, University vacations were of a fairly good length and sufficient to afford the keen student opportunity to undertake some practical work on an undertaking. Gas undertakings in the district were very generous in their willingness to co-operate in this respect and one could only hope that if ever they began to feel they were being "put upon" by the University in that respect they would have the satisfaction of knowing that the University was ready and anxious to be of help to them in return in any way in its power.

Following the meeting the members had tea together at the Griffin Hotel, Leeds. During a smoking concert in the evening the Clayton Award for the best paper read before the Yorkshire Association during 1933 was presented to Mr. H. Wadsworth (Harrogate).

Progress of Illumination

At a meeting of the Illuminating Engineering Society last week a report was presented by the Technical Committee of the Society: Mr. A. W. Beuttell (Chairman), Mr. J. G. Clark, Mr. J. S. Dow, Mr. W. J. Jones, Mr. C. A. Masterman, Mr. Wm. Millner, Mr. T. E. Ritchie, Mr. Howard Robertson, Mr. H. C. Wheat, Mr. G. H. Wilson. Co-opted: Mr. H. Buckley, Mr. H. Lingard.

It is stated that co-operative effort between a large London gas undertaking and three firms of gas lamp manufacturers has led to the introduction of a new form of low-pressure street lamp, of modern appearance and attractive design. The "globe" is built up of two prismatic end pieces, semi-circular in section, and two side panels, also of prismatic glass, the design of which can be varied so that the unit may be suitable either for central suspension or for use on columns with brackets overhanging the road surface. Types are available giving axial distribution (*i.e.*, beams at 180° to each other) and non-axial distribution (*i.e.*, beams at 160° to each other). The refractory dishes introduced last year are now available to suit three sizes of round lanterns utilizing up to 4, 5-6, and 8-12 mantles respectively. Each gives a two-way distribution with main beams at 160° to each other. The intermediate size has been slotted to enable it to be used in square type lanterns with the burners fed from underneath. The slot enables the glass to pass over the feed and by-pass tubes easily, thus facilitating maintenance.

Special forms of mirror glass reflectors, for use with the usual form of low-pressure unit, have been developed. The tendency to replace one mantle of high candle-power by three mantles each of lower power in high-pressure gas lamps has been continued. Directional reflectors have been applied with success to such lamps.

Outside Shop Lighting Units.—In this field there has been a marked improvement in design and appearance. A lamp rectangular in shape, and in keeping with the architecture of modern shop fronts, executed in steel or chromium plating has been designed. The gas and air regulators are hidden but accessible. The distant lighting device is incorporated in an arm consistent in design with the lamp. Another unit for this purpose of circular design and with simple maintenance may be used in conjunction with either prismatic or opal glassware. Specially built up globes of opal glass have also been developed.

Floodlighting Equipment.—Heat resisting mirror glass reflectors for use with floodlighting units in atmospheres corrosive to chromium-plated reflectors have been developed and have proved satisfactory in operation, enabling an increase in the available flux of light and reducing maintenance costs. Floodlighting units in which the mantles are arranged in line-formation have been adopted with success.

Indoor Lighting Units.—Here also a feature has been the use of gas and air regulators easily accessible but completely hidden. Appearance has been improved by the use of enamelled steel surfaces in attractive pastel shades. Modifications in the design of nozzles and the form of primary air inlets to domestic burners have led to an understanding of the factors necessary to the production of silent burners, which it is hoped will become standard for domestic equipment. Attention has also been devoted to the artistic appearance of domestic fittings. A new form of ceiling plaque, finished in cellulose paint, has been evolved in order to prevent the blackening of ceilings.

A new industrial lamp, having a neater appearance together with a diffusing glass shield to prevent direct view of mantles, has been developed. An unusual feature of this lamp is the ratchet cock actuated by a single chain.

Public Lighting.

During the past year recognition of the value of good street lighting has grown. Improvement in existing street lighting, whilst still delayed for economic reasons, has been encouraged by better informed technical and public opinion, by the claims of road safety, and by new facilities as regards illuminants and accessories. House-building and street-making have led to numerous new installations.

The Road Traffic Act has directed attention to the subject owing to its imposition of a speed limit on roads in "built-up areas" deemed to be so "if a system of street lighting maintained at the expense of the rates is provided thereon." This definition has been the subject of much discussion and deputations from the Illuminating Engineering Society, the Association of Public Lighting Engineers, and other bodies interested have been received by the Ministry of Transport. General opinion seems to favour the view that the Act, whilst apparently presenting certain difficulties, is not likely to prove prejudicial to progress in public lighting, though in principle the association of a speed limit with the provision of public lighting is regarded as illogical.

Another step of considerable importance has been the appointment, under the Ministry of Transport, of a Departmental Committee on Street Lighting, whose terms of reference are "to examine and report what steps could be taken for ensuring more efficient and uniform street lighting, with particular reference to the convenience and safety of traffic and with due regard to the requirements of residential and shopping areas, and to make recommendations." On this Committee C. C. Paterson and J. W. T. Walsh, both Past Presidents of the Society, and C. A. Masterman, a Member of Council, are serving.

Railway Lighting.

A development in gas lighting on the railway has been the use at some stations on the Great Western Railway (notably Bristol) of a new type of lantern fitted with hexagonal opal-glazed reflector and skirt. The lanterns are fitted with clusters of three or four No. 2 burners and give a very high duty.

A modified form of this fitting has been used at Bournemouth, in which one side of the reflector and skirt has been glazed with clear glass, which is equivalent to cutting away the reflector on that side, and has the effect of allowing useful illumination to fall on advertisements and notice boards attached to the back wall of the platform. Opportunity has also been taken to incorporate an illuminated station name-plate in the lantern.

Showroom and Window Displays*

By W. R. Oliver, Display Officer to the B.C.G.A.

The word " display " can have only one meaning so far as industry is concerned—namely, the medium through which sales are promoted. Windows are the eyes of a business looking out on to the passing world; bright eyes are healthy. Do you keep *your* windows bright?

It is now over ten years ago since I first put those words on to paper, and they were written in a letter to Mr. Herbert N. Casson, the Editor of the *Efficiency Magazine*. He used them in his first book on Window Display, and they have also been used as the opening paragraph to a book on Window Display written by an American.

The statement still stands good to-day. The passer-by judges the interior of your showroom and your organization through the eyes of your windows. Dull, uninteresting, unattractive windows give people the impression of a sick, disorganized business; and I want to impress upon the minds of every manager, display man, and salesman in the Gas Industry how vitally important it is that, at all times and under all conditions, the showroom window displays associated with such a great Industry as ours, must at all costs be brought up-to-date and be maintained bright, topical, cheerful, interesting, and educating to the public.

Modern display is the art of using any given space to create sales, and calls for specialized knowledge. The modern display man must possess sales sense, advertising sense, creative ability, and showmanship. The display man has one of the most difficult tasks in any organization. He must always be on the alert for new ideas. He must do what has not been done before; he is not a routine man—he is a designer, a thinker, and a pioneer. In order to achieve the best results, he must be given a certain amount of authority. His work is always judged by results, and he should be given a free hand to do his very best.

Strong, forceful work is needed, coupled with simplicity and directness. Modern display, of course, demands some natural aptitude. The so-called " born " display man has no real existence apart from this matter of aptitude, which is not enough, needing, as it does, the reinforcement of knowledge.

Given the possesssion of that aptitude, the would-be display man is still wanting in essential knowledge of various kinds. It has been said that " any young man who has a flair for colour and line, who has imagination and inventive ability and an appreciation of artistic and beautiful things, *plus* a knowledge of salesmanship," would do well to choose display as his life work. He will not find himself in a dead-end job; his work will be seen; he will rise as high as he deserves to rise, and he will find that his work is educative, that every year he will grow stronger and more competent.

Be the first in your town to make out-of-the-ordinary window displays, and you will pull people across the street to see them, even pull them from other parts of the town. Try to create something original and compelling.

How many shops in your main street do you pass every day without noticing them? Just think it over. Leave home ten minutes earlier in the morning and check up on them, and you will find that they all lack interest. Goods are displayed in a dull, dismal fashion that simply leaves you cold. Do the windows of your own showrooms bring you up with a halt?

The Gas Industry possesses some of the finest windows and showrooms in the country. Let us use these windows for all we are worth. When we say to the public " Get up-to-date with Gas," let each and every one of us say to ourselves, we must be up-to-date with gas showrooms and window displays. It is your duty to your individual undertaking and to the Industry as a whole to make your windows the most interesting in your particular town. Never let a National or local event slip by without a link-up. Make it a household saying—" Have you seen the gas showrooms this week?"

Strive at all times for originality in display. Window display is no longer an experiment. It can be depended upon to increase sales if it is done properly, and it is of untold value to every salesman.

Ever-Changing Design.

One of the most important influences that the display man has to deal with to-day is the ever-changing design in modern homes. One section of the community is forsaking the city and overcrowded spaces, moving to the open spaces of the outer suburbs. In these areas houses are built, the design of which defies description. In many cases they waver between Tudor and Turkish, and from log cabin to White House, and yet they all must have light, heat, and power. On the other hand, we find another section of the community leaving the outer suburbs in favour of the inner suburbs, where they are residing in modern up-to-date flats that require quite a different type of appliance than needed elsewhere.

What is the consequence? Manufacturers have been compelled to design gas appliances to meet this modern trend in living, and we now observe some very interesting results. For instance, we have cookers that have the appearance of wireless cabinets when closed. It is not for me to discuss here the design of appliances, but I cannot overlook the fact that they can present a false impression as to their cooking capabilities on account of their compactness, unless they are displayed properly. When closed they give one the impression that they will hold no more than a couple of chops which, you will agree with me, holds no appeal to a woman with a family of four, or even to a man with a man's appetite.

Therefore display your cookers. Show real or dummy food inside them (if the latter, let it be of good quality and appear real). Let your display remove all doubt from the minds of the beholder regarding the capabilities of your appliances.

Good window displays can sell refrigerators in the winter, gas fires in summer, and cookers all the year round. People want what they look at, if the looking interests them sufficiently enough.

All of you, no doubt, have seen the display embodying a photograph of a baby, which I introduced into our autumn advertising campaign " Please Mr. Therm." I have been asked numerous times during the past few weeks what prompted me to use this particular idea. I will tell you. The psychology of display and salesmanship.

The study of display and salesmanship is one long study of human nature. Why do we do the things we do? The psychologist finds the explanation of human actions in certain inward promptings and urgings termed " desires." The whole object of display is to create " desires." We humans have desires for physical well-being, for light, comfort, different kinds of food-stuffs, for chairs, wireless, motor cars, and a host of other things, but the great desires are for food, drink, and warmth, and the greatest " desire " of all—the " desire " to carry on the race. That is why I used the baby.

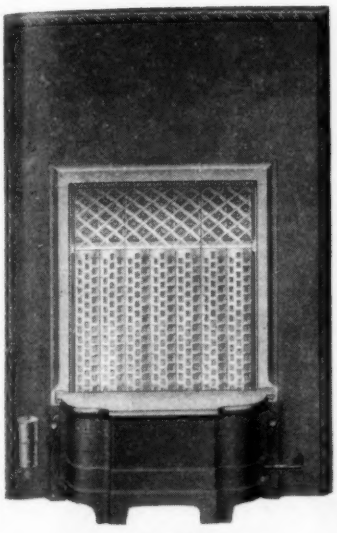
Love of offspring offers the greatest appeal in selling. It is a deep-rooted instinctive desire, handed down to us through the ages, and will go on until the end of all time. Appeal to the public through the medium of their children, and you cannot fail to arouse their immediate interest.

The British Commercial Gas Association was founded to further all forms of co-operative selling on behalf of the Gas Industry. Our Press advertising and our Salesman's Course are two phases of this work. But without proper method of display they are shorn of their full effect. Press advertising in itself is not enough; enthusiastic salesmanship in itself is not enough; all our selling efforts need to be knitted together, so that each reinforces the other. The National advertising which the Association conducts—the local advertising which you gentlemen put out—must be logically and systematically linked with your displays if you are to get full value from the money you spend on sales promotion. And it is at this vital point that the B.C.G.A. Studio can help you.

I want all and every one of you fully to appreciate and realize that the slogan we have thought fit to adopt in our Studio—namely, " To Serve "—is a live and sincere one. We are there for the one purpose—to help and serve you. If you have any problems or lack of ideas in connection with your displays, whether for window, showrooms, or exhibitions, please call upon us, and you can rest assured that any problem—either large or small—will receive our fullest attention, consideration, and co-operation.

* From a paper read before the Eastern District of the Southern Association of Gas Engineers and Managers, Oct. 10, 1934.

New High "Beam" Fires



The "Varsitie."

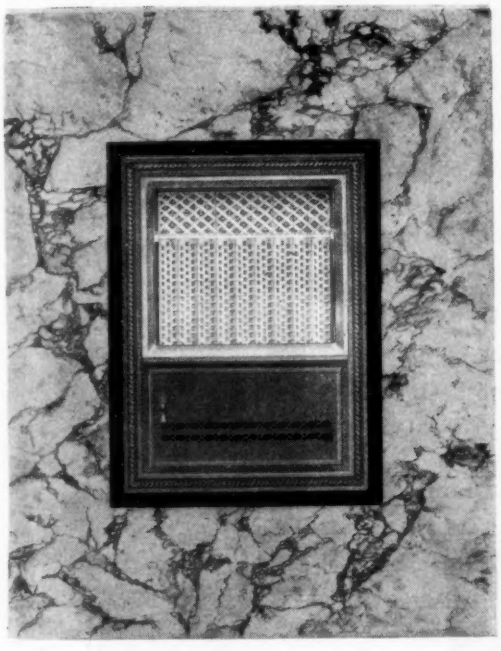
Interest in the High "Beam" gas fires has been further increased by the introduction of the John Wright (Radiation Ltd.) designs which are now on display in many showrooms throughout the country. Two of the new patterns are built-in fires of most attractive design, simple in treatment yet with that dignity which comes when straight lines supersede ornament.

The "Inlae" built-in High "Beam" gas fire is a square pattern designed for fitting above hearth level. The illustration shows the "Inlae" fitted into a surround of marble, but this fire is equally suitable for fitting into a metal, stone, or plaster background. A pleasing feature of the "Inlae" is the chromium-plated frame reflector surround in which the radiants are framed. This adds much to the appearance of the firefront, and increases the glowing effect when the fire is lighted. The self-lighting gas tap is supplied with the "Inlae" and is operated by the neat little tap seen on the left of the fire.

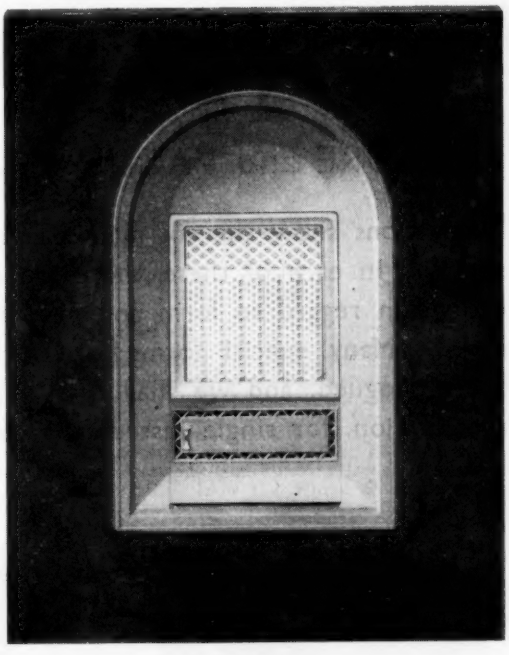
A round-topped built-in High "Beam" gas fire is the "Niche," also designed, like the "Inlae," for fitting above hearth level. The front of this fire is of an entirely new design being slightly recessed, and when fitted into a marble or other surround the effect is most pleasing. This High "Beam" fire has chromium-plated frame surround.

The "Varsitie" is a new design of High "Beam" for use at floor level. This is a gas fire of particularly neat appearance designed on lines of extreme simplicity and without the usual projecting canopy. The fire fits flush with the wall and is in keeping with modern decorative ideas. As will be seen from the photograph, the chromium-plated frame surround is also embodied in this design.

John Wright High "Beam" gas fires are supplied in the "Sunsheen" colour finishes. These finishes have been produced after long trials and are remarkable in their quality and variety. Of special interest are the facsimile metal finishes, hammered pewter, hammered copper, and hammered brass. The widespread national advertising is now bringing these High "Beam" gas fires to the notice of consumers everywhere, who will be even more impressed when they see the actual fires which are claimed to "save one therm in every eight." Showroom literature is available showing these new John Wright models in full colours in addition to other High "Beam" designs.



The "Inlae."



The "Niche."

Gas Undertakings Results.

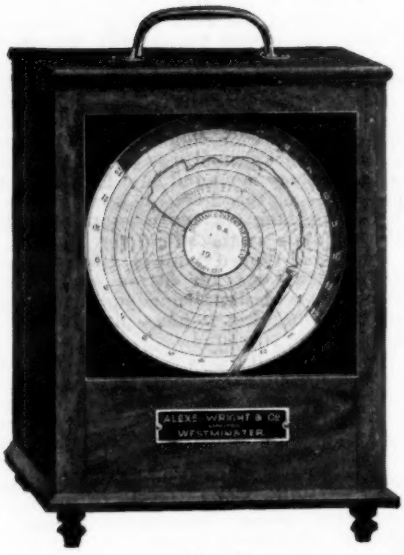
Deal (S.E. Gas Corporation).

The report and statement of accounts of the Deal and Walmer Gas Company for the year ended June 30, 1934, state that there has been an increase in the sales af gas amounting to approximately 1½%, as compared with the previous year. The capital account shows that the expenditure during the year amounted to £4,169. On the revenue account, there was a reduction of approximately £1,200 in the cost of manufacture. Distribution expenses were up slightly, and there was an increase of nearly £400 in rates, owing to the re-assessment of the Undertaking. On the receipts side of the account, sales of gas showed an increase of £525, and rental of meters, stoves, and hired goods were greater by £100. In sales of residuals, coke and breeze were down by £440. On the other hand, sales of tar were up by £160. The profit on fittings account increased by £412, due to the fact that showroom sales and gas fitting work amounted to £1,512 more than in the previous year. The net result was an increase in the balance carried to net revenue account of £2,010. In the net revenue account there is a debit for income-tax this year of £265, against a credit written back of £317 in the previous year, and the final result is that the balance available for dividend amounts to £5,417, an increase of £1,500 on the corresponding figure last year. Out of this the Directors recommended the payment of dividends for the June half-year at the same rate as for the corresponding period last year—namely, 6½% on the preference stock and 7¾% on the ordinary stock. This absorbed the sum of £3,687, leaving a balance of £1,729 to be carried forward to the next account, as compared with £221, brought forward from last year.

West Kilbride.

The shareholders of the West Kilbride Gas Light Company, Ltd., held their annual general meeting on July 26. The statement of accounts showed that the revenue for the year amounted to £4,437, and expenditure to £3,893, leaving a profit of £544. A dividend of 7½% was declared to the shareholders, which is the same as last year. The total amount of gas made was 16,460,600 c.ft.

No. 893



No. 471

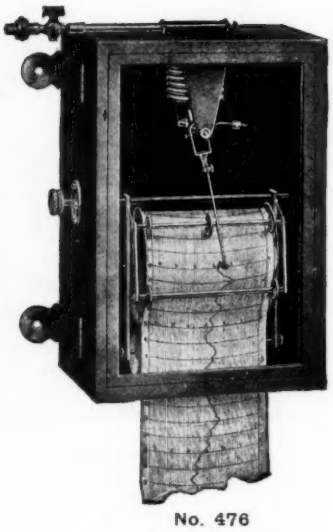
No. 892

SIMMANCE PATENT

DEAD-BEAT

PRESSURE and VACUUM RECORDERS

Illustrations show the six main patterns in constant supply. In each of these there are available modifications in regard to form and size, range and chart-speed. Many special forms of Dead-Beat Recorder are catalogued, and we shall be glad to quote against specification, for single instruments or for batteries.



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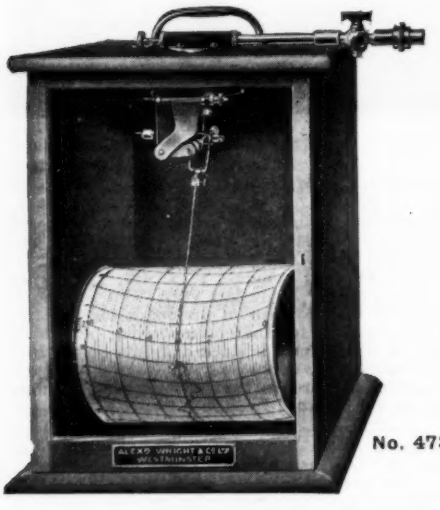

No. 473

No. 673

ALEXANDER WRIGHT & CO., LTD., WESTMINSTER, S.W.1

Gas Markets and Manufactures

Stock Market Report.

[For Stock and Share List, see later page.]

The enormous amount of money which has been tied up in new issues during the past few weeks took its toll of normal Stock Exchange business last week. Actual transactions became limited, and investors, pausing to take stock of the position, were disinclined to part with their holdings, so that dealers found difficulty in obtaining supplies. Despite this falling off in ordinary transactions, however, gilt-edged and other high-class investment securities maintained their values. Industrials on the whole were a trifle weaker, though there were one or two bright spots, notably Marks & Spencer and Cables, but with the opening of the new Account this week it is anticipated that markets generally will become more animated.

As is very often the case, the Gas market continued unaffected by the general situation, and business showed little, if any, falling off, while a number of stocks recorded big increases in value. A feature was the renewal of strength in Gas Light units, which, after a gain of 3d. the previous week, rose a further 9d. to 27s. 9d. At the time of writing 5,000 of these units are on offer at 28s., at which price the yield, subject to the dividend being maintained at £5 12s.%, works out at 4%, so that in one case at least the forecast in the Report published a fortnight ago has already become an established fact. Another important gain was that of Uxbridge ordinary with 10 points to 165½, while the Company's 5% preference stock rose 6 to 123½. British 5½% preference hardened 8 to 114½ (yielding £4 16s.%), and among those undertakings operating abroad Colombo 8% preference was moved up 1s. to 25s. 6d., and Bombay 6d. to 92s.

The Directors of the Imperial Continental Gas Association have announced the payment of an interim dividend for the half-year to Sept. 30 last, which is maintained at 5%. It will be remembered that for the past two years the Association has distributed a final dividend of 7%, making 12% for the year. The Oriental Company is maintaining the final dividend at 4½%, free of tax, making 8%, free of tax, for the year to June 30, the same rate as for 1932-33.

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *Oct.* 22.

Business in tar products has been quiet during the past week, with current values as under:

Pitch, about 55s. per ton f.o.b.

Creosote is firm at 4d. to 4¼d.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, about 2s. 2d.; pure benzole, 1s. 9d. to 1s. 10d.; 95/160 solvent naphtha, about 1s. 7d.; and 90/160 pyridine, about 7s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

Oct. 22.

The average prices of gas-works products during the week were: Gas-works tar, 23s. 6d. to 28s. 6d.; Pitch—East Coast, 51s. to 53s. 6d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 51s. to 53s. 6d.* Toluole, naked, North, 1s. 6d. to 1s. 8d. Coal-tar crude naphtha, in bulk, north, 6¼d. to 6¾d. Solvent naphtha, naked, North, 1s. 4½d. to 1s. 5d. Heavy naphtha, North, 9¾d. to 10¾d. Creosote, *ex* works, in bulk, North, liquid and salty, 3⅜d. to 3⅝d.; low gravity, 3⅜d. to 3⅝d.; Scotland, 3¼d. to 3½d. Heavy oils in bulk, North, 3⅜d. to 4¼d. Carbolic acid, 60's, 1s. 8d. to 1s. 9d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2½d. to 3d. per minimum 40%, purely nominal; "B" quality, unsaleable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *Oct.* 20.

New business is decidedly scarce in this area, although deliveries against old contracts are proceeding quite rapidly.

Crude gas-works tar.—Actual value is 32s. to 34s. per ton *ex* works in bulk.

Pitch.—Continental business is still difficult, but prices are being maintained for vertical grade at round 45s. per ton f.o.b. Glasgow for export and 42s. 6d. per ton f.o.r. in bulk for home trade.

Refined tar is now valued at 3d. to 3¼d. per gallon naked at makers' works.

Creosote oil.—Values are well maintained with stocks low. B.E.S.A. Specification, 4d. to 4¼d. per gallon; low gravity, 4¼d. to 4¾d. per gallon; and neutral oil, 4¼d. to 4½d. per gallon; all f.o.r. in bulk.

Cresylic acid.—While little new business is being fixed, prices continue steady. Pale, 97/99%, is 1s. 3d. to 1s. 4d. per gallon; dark, 97/99%, 1s. 0½d. to 1s. 1½d. per gallon; and pale, 99/100%, 1s. 4½d. to 1s. 5½d. per gallon; all *ex* works.

Crude naphtha continues to find a fairly steady outlet at 4½d. to 5d. per gallon, according to quality.

Solvent naphtha.—90/160 grade is 1s. 3d. to 1s. 4d. per gallon, while 90/190 grade remains nominal at 8d. per gallon.

Motor benzole.—1s. 5d. per gallon (nominal).

Pyridines.—90/160 grade is 6s. 9d. to 7s. 3d. per gallon, and 90/140 grade 7s. to 8s. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole	0	9	to	0	9½	per gallon at works
Motor ,,	1	3½	,,	1	4	,, ,, ,,
90% ,,	1	4	,,	1	4½	,, ,, ,,
Pure ,,	1	7½	,,	1	8	,, ,, ,,

New Capital Issues.

Uxbridge Company.—The tenders for the new capital which Messrs. A. & W. Richards offered for the Directors of the Uxbridge, Maidenhead, Wycombe, and District Gas Company were opened on Oct. 18. For the £20,000 5% preference stock applications were sent in for £86,282 at prices ranging from £128 1s. down to the minimum of £123 10s. per £100. The lowest accepted tender was at £125, and the average obtained £126 12s., at which the yield is £3 19s.%. For the £19,000 ordinary stock tenders were sent in for £94,087 at prices ranging from £165 down to the minimum of £158 per £100. The lowest accepted tender was at £163 1s., and the average worked out to £163 6s., yielding £4 5s. 9d.%.

Contracts Advertised To-Day.

Pipes and Specials.

Morecambe and Heysham Gas Department. [p. 290.]

Trade Notes.

International Combustion, Ltd.

International Combustion, Ltd., of Aldwych House, W.C. 2, announce that the amalgamation of the interests of the following Companies in the parent concern has now been completed: Underfeed Stoker Company (now the Underfeed Stoker Division), Combustion Steam Generator, Ltd. (now the Steam Generation Division), Mining and Industrial Equipment, Ltd. (now the Grinding, Screening, and Filtering Division), and Combustion Engineering, Ltd. (now the Works Division). Communications hitherto addressed to any of the absorbed Companies should now be referred direct to International Combustion, Ltd.

Steel Cycle Parks.

The latest catalogue of Messrs. Constructors, Ltd., of London and Birmingham, gives details of the various types of patented steel cycle parks which this firm manufacture. A large installation which they have carried out is at the Ford Motor Works, Dagenham, providing accommodation for several thousands of cycles. Although the number of cycles which this firm has to provide for is unusually large, the need for efficient cycle park accommodation is exactly the same in the small works where parking for only 10 or 20 cycles is required, and the wide variation in the size of the parks which are purchased from this firm proves that the efficiency of this equipment is fully appreciated by all users.

Huntington, Heberlein, & Co., Ltd.

Colliery Engineering Limited, which was recently formed with a strong financial backing, to take over the business relating to equipment for the treatment and preparation of coal and coke for the market, previously carried on by Huntington, Heberlein, and Co., Ltd., of London and Newcastle; Dry Washers (Coal and Minerals), Ltd., of Sunderland; and Newton Chambers & Co., Ltd., of Thorncliffe, near Sheffield, has now established central offices at 46, Rutland Park, Sheffield. The aim is to make available to the colliery industry experience and technique embracing practically every phase of the treatment and preparation of coal and coke above ground, including wet washing, dry cleaning, de-dusting, screening, and conveying.

The installation of GLOVER-WEST *vertical retorts at the works of the*

EAST HULL GAS COMPANY

was started to work
on Tuesday, Aug. 14th, 1934

This is NOT a test; it is a week's normal run on a typical Yorkshire coal:

COALS CARBONIZED.	550 tons
TOTAL GAS MADE. . .	11,030,000 c.ft.
CALORIFIC VALUE. . .	465 B.Th.U/c.ft.
MAKE PER TON.	20,060 c.ft.

. . . equivalent to

93·3

therms per ton

WEST'S GAS IMPROVEMENT CO., LTD.
MILES PLATTING, MANCHESTER, 10

Telephone : COLLYHURST, 2961.

Telegrams : "STOKER, MANCHESTER"

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations. Oct. 19.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Sept. 10	7	7	Alliance & Dublin Ord. ...	132—142	...	139—140½
374,000	"	June 25	4	4	Do. 4 p.c. Deb. ...	90—100	...	...
557,655	"	Aug. 13	7	7	Barnet Ord. 7 p.c.	165—170	...	169
300,000	1	Oct. 8	1/9‡	1/4‡	Bombay, Ltd.	28/— 30/-	+·/6	29/1½—30/-
178,480	Stk.	Aug. 13	9½	9½	Bournemouth sliding scale	225—230	...	...
550,050	"	"	7	7	Do. 7 p.c. max. ...	168—173	...	...
439,160	"	"	6	6	Do. 6 p.c. Pref. ...	142—147	...	...
50,000	"	June 11	3	3	Do. 3 p.c. Deb. ...	85—90	...	88½
262,025	"	"	4	4	Do. 4 p.c. Deb. ...	105—110	...	109½
335,000	"	"	5	5	Do. 5 p.c. Deb. ...	125—130	...	127—129
857,900	"	Aug. 13	7½	7½	Brighton, &c., 6 p.c. Con. ...	173—177	...	175½—177
540,000	"	"	6½	6½	Do. 5 p.c. Con. ...	155—160	...	159—160
195,500	"	"	6	6	Do. 6 p.c. B. Pref.	142—147	...	...
1,487,500	"	July 9	5	5	Bristol 5 p.c. max.	120½—121½*a*	...	...
120,420	"	June 11	4	4	Do. 1st 4 p.c. Deb. ...	102—105*a*	...	...
217,870	"	"	4	4	Do. 2nd 4 p.c. Deb. ...	102—105*a*	...	...
338,790	"	"	5	5	Do. 5 p.c. Deb.	123—125*a*	+2	...
865,000	"	Sept. 24	8	7	British Ord.	158—163	...	161—161½
100,000	"	June 11	7	7	Do. 7 p.c. Pref.	154—159	...	...
350,000	"	"	5½	5½	Do. 5½ p.c. Pref.	112—117	+8	...
120,000	"	"	4	4	Do. 4 p.c. Red. Deb. ...	98—103	...	...
450,000	"	"	5	5	Do. 5 p.c. Red. Deb. ...	107—112	...	...
160,000	"	June 11	5	5	Cambridge 5 p.c. Deb. ...	115 120	...	...
100,000	10	22 May '33	6	4	Cape Town, Ltd.	2—4	...	...
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	4 6	...	...
150,000	Stk.	July 23	4½	4½	Do. 4½ p.c. Deb. ...	90 - 95	...	...
626,850	"	July 23	6	6	Cardiff Con. Ord.	131 - 136	...	134½
287,850	"	June 11	5	5	Do. 5 p.c. Red. Deb.	107—112	...	...
157,150	"	July 23	5½	5	Chester 5 p.c. Ord.	113—118*b*	...	...
98,936	1	Sept. 24	2/-	2/-	Colombo, Ltd. Ord.	1⅞—1⅞‡	...	...
24,500	1	"	1/4‡	1/4‡	Do. 7 p.c. Pref. ...	19/6 - 21/6	...	...
609,204	1	Sept. 24	-/11'48	-/11'48	Colonial Gas Assn. Ltd. Ord.	19/6 - 21/6	...	20/-
296,053	1	"	1/8'30	1/8'30	Do. 8 p.c. Pref.	24/6—26/6	+1/-	25/6—26/8
1,775,005	Stk.	July 23	6½	5	Commercial Ord.	120—125	...	121½—123
475,000	"	June 11	3	3	Do. 3 p.c. Deb. ...	83—88	...	...
286,344	"	Aug. 13	5	5	Do. 5 p.c. Deb. ...	122—127	...	...
807,560	"	Aug. 13	7	7	Croydon sliding scale ...	158—163	...	162½
669,590	"	"	5	5	Do. max. div.	107—112	...	...
630,585	"	June 25	5	5	Do. 5 p.c. Deb.... ...	123—128	...	...
842,270	"	Aug. 13	10	7	Derby Con.	180—185*a*	+3	...
55,000	"	June 25	4	4	Do. 4 p.c. Deb.	100—105*a*	...	...
209,000	"	Aug. 13	5	5	East Hull Ord. 5 p.c. ...	108—112	...	...
181,625	"	Aug. 13	6	5	East Surrey Ord. 5 p.c. ...	132—137	...	...
175,609	"	June 11	5	5	Do. 5 p.c. Deb. ...	120—125	...	...
1,002,180	"	Sept 10	†7	†5	European, Ltd.	122—127	...	124½—124½
19,342,753	"	Aug. 13	5½	5½	Gas Light & Coke 4 p.c. Ord.	27/6—28/-*f*	+·/9	27/—28/-
2,600,000	"	"	3½	3½	Do. 3½ p.c. max.	88 - 91	...	90 - 91
4,477,106	"	"	4	4	Do. 4 p.c. Con. Pref.	106—109	...	107½ 109
6,102,497	"	May 28	3	3	Do. 3 p.c. Con. Deb.	88—91	+1	89—£9½
3,642,770	"	"	5	5	Do. 5 p.c. Red. Deb.	116—119	...	...
2,500,000	"	"	4½	4½	Do. 4½ p.c. Red. Deb. ...	114—117	...	115—116
270,456	"	Aug. 13	6	6	Harrogate New Cons. ...	127—132	...	...
140,000	1	Sept. 24	1/7½	1/7½	Hongkong & China, Ltd. ...	1⅛—1⅜*	...	...
218,200	Stk.	Aug. 13	6	5	Hornsey Con. 3½ p.c. ...	137—142	...	...
5,600,000	"	May 28	10	14	Imperial Continental Cap.	216—221	...	216—218½
228,130	"	July 23	3½	3½	Do. 3½ p.c. Red. Deb.	92—97	...	94
235,242	"	Aug. 13	3½	3½	Lea Bridge 5 p.c. Ord. ...	166—172	...	...
2,167,410	"	Aug. 13	6	6	Liverpool 5 p.c. Ord. ...	135—136*b*	...	...
245,500	"	June 11	5	5	Do 5 p.c. Red. Pref. ...	105—115*b*	+4	...
806,088	"	July 16	4	4	Do. 4 p.c. Deb. ...	102—104*b*	...	...
11,751	"	Aug 27	10	8	Maidstone 5 p.c. Cap. ...	180—190	...	...
63,480	"	June 25	3	3	Do. 3 p.c. Deb. ...	75—80	...	...
75,000	"	May 28	†10	†10	Malta & Mediterranean ...	200—210	...	...
399,000	–	Oct. 1	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	100—103	...	...
231,978	Stk	Aug. 13	5	5	M. S. Utility "C." Cons. ...	111—116	...	...
818,657	"	"	4	4	Do. 4 p.c. Cons. Pref.	97—102	...	...
360,075	"	June 11	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
148,955	"	"	5	†5	Do. 5 p.c. Deb. ...	119—124	...	...
125,000	—	July 2	...	11/8	Do 3½ p.c. Rd. Rg. Bds.	97—100	...	...
675,000	"	May 28	†6	‡13	Montevideo, Ltd.	60—65	...	...
2,061,315	"	Aug. 13	6½	5	Newcastle & Gateshead Con	45/3—26/8*d/f*	...	...
682,856	"	"	4	4	Do. 4 p.c. Pref. ...	103—105*d*	...	...
776,706	"	June 11	3½	3½	Do. 3½ p.c. Deb. ...	92½—93½*d*	...	...
277,285	"	May 7	5	5	Do. 5 p.c. Deb. '48 ...	108—107*d*	...	...
274,000	"	Aug. 13	5	5	Newport (Mon.) 5 p.c. max.	105—107*a*	...	...
204,940	"	Aug. 13	7½	7½	North Middlesex 6 p.c. Con.	155—160	...	...
396,160	"	Aug. 13	5	5	Northampton 5 p.c. max. ...	107—112*	...	...
300,000	"	May 7	†9	†7	Oriental, Ltd.	170—175	+2	173—174
416,617	"	June 11	8	8	Plym'th & Stonehouse 5 p.c.	178—183	...	...
504,416	"	Aug. 13	8	8	Portsm'th Con. Stk. 4 p.c. Std	177—182	...	...
241,446	"	"	5	5	Do. 5 p.c. max. ...	105—110	...	...
114,000	"	July 23	5	5	Preston 5 p.c. Pref.	101—106	...	...
1,736,968	Stk.	Aug. 27	6	6	Sheffield Cons.	139—141*e*	+1	...
95,000	"	July 9	4	4	Do. 4 p.c. Deb.	100—104*	...	...
133,201	"	Aug. 13	5	5½	Shrewsbury 5 p.c. Ord. ...	137—142	...	...
90,000	10	May 28	†4	†3	South African	2—4	...	6½-
927,177	1	Sep. 10	1/2‡	1/2‡	South East'n Gas Cn. Ld Ord.	28/— 30/-	...	29/9— 30/-
736,051	1	..	-/10‡	-/10‡	Do. 4½ p c. Red. Cum. Pref.	22/— 23/-	...	...
450,000	Stk.	Aug. 13	7‡/4	4	Do. 6 p.c. Red. Deb. ...	102—105	+1½	103½—104½
6,709,895	"	Aug. 13	7	5	South Met. Ord.	139—142	...	140½—142
1,135,812	"	"	6	6	Do. 6 p.c. Irred. Pf.	142—147	...	145½—146½
850,000	"	"	4	4	Do. 4 p.c. Irred. Pf.	104—107	...	...
1,895,445	"	June 25	3	3	Do. 3 p.c. Deb. ...	87—90	...	90
1 000,000	"	July 9	5	5	Do. 5 p.c. Red. Deb.	115—118	...	...
209,820	"	Aug. 13	5½	5½	South Shields Con.	169—171*d*	...	...
1,543,795	"	July 9	6	6	South Suburban Ord. 5 p.c.	133—136	...	135—136
512,825	"	"	5	5	Do. 5 p.c. Pref.	122—127	+2	...
300,000	"	"	4	4	Do. 4 p.c. Pref.	101—106	...	...
868,857	"	June 11	5	5	Do. 5 p.c. Deb.	123—128	+1	...
100,000	"	"	4	4	Do. 4 p.c. Deb.	102—107	...	...
647,740	"	Aug. 13	5	5	Southampt'n Ord. 5 p.c. max.	112—117	...	...
121,275	"	June 11	4	4	Do. 4 p.c. Deb.	99—104	...	...
350,000	"	Aug. 13	5½	5½	Swansea 5½ p.c. Red. Pref.	107—112	...	...
200,000	"	June 11	6½	6½	Do. 6½ p.c. Red. Deb.	102—107	...	...
1,076,490	"	Aug. 13	6½	6½	Tottenham and District Ord.	155—160	...	157—159
469,835	"	"	5½	5½	Do. 5½ p.c. Pref. ...	130—135	...	...
62,235	"	"	5	5	Do. 5 p.c. Pref. ...	118—123	...	...
199,005	"	June 11	4	4	Do. 4 p.c. Deb. ...	100—105	...	...
349,110	"	Aug. 13	7	7	Uxbridge, &c., 5 p.c. ...	163—168	+10	...
88,330	"	"	5	5	Do. 5 p.c. Pref. ...	121—126	+6	...
1,326,700	"	Aug. 13	7	7	Wandsworth Consolidated	160—165	+2	162—162½
1,371,378	"	"	5	5	Do. 5 p.c. Pref.	121—126	...	...
1,317,964	"	June 11	5	5	Do. 5 p.c. Deb.	128—128	...	126½—127
208,300	"	"	...	26/8	Do. 4 p.c. Deb. ...	104—107	...	...
158,400	"	Aug. 13	6*g*	5	Winchester W. & G. 5 p.c. Con.	120—125	...	...

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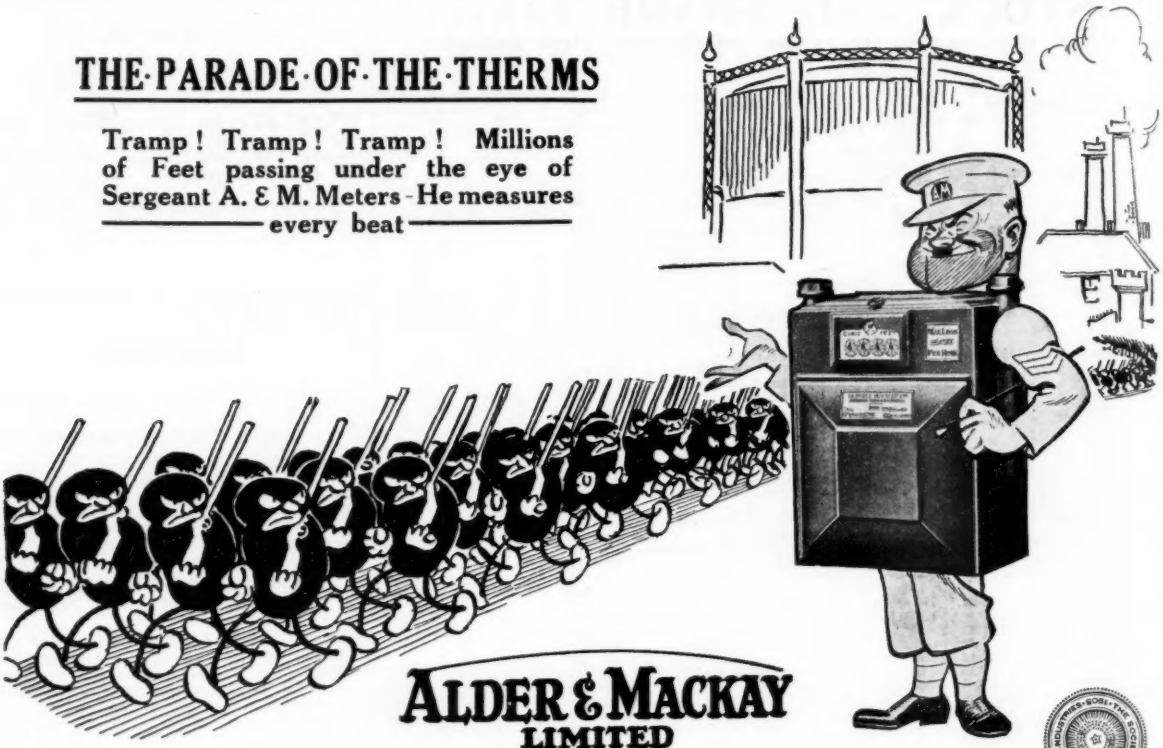

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